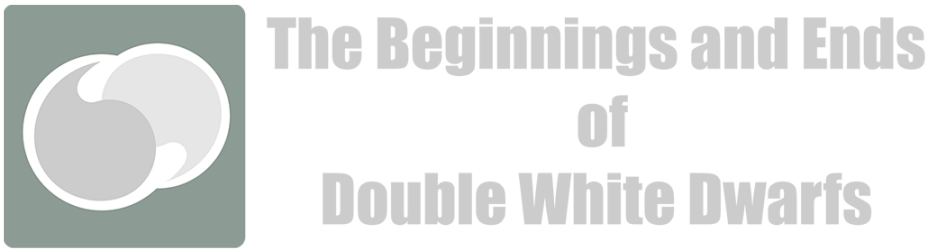
The Beginning and Ends of Double White Dwarfs



Report of Contributions

https://indico.nbi.ku.dk/e/1161

Contribution ID: **2** Type: **Talk**

Three-dimensional simulaitons of double detonations in the double-degenerate models for type Ia supernovae

Thursday 4 July 2019 10:05 (20 minutes)

The discovery of hypervelocity white dwarfs strongly supports the Dynamical-Driven Double-Degenerate Double-Detonation (D^6) model for type Ia supernova scenario. We have performed high-resolution SPH simulations of D^6 explosions in various double-degenerate systems. We have found several explosion modes. In this presentation, we will show observational features of these explosion modes.

Author: TANIKAWA, Ataru (The University of Tokyo)

Presenter: TANIKAWA, Ataru (The University of Tokyo)

Session Classification: Supernovae & their Aftermath

Contribution ID: **4** Type: **Talk**

White Dwarf Tidal Interactions

Tuesday 2 July 2019 12:10 (20 minutes)

The tidal interactions of white dwarf binaries are crucial for understanding the fates of these systems when they merge, connecting them to different classes of astrophysical explosions and other binary systems. New discoveries of compact white dwarf binaries are putting important constraints on these tidal interactions. In the future, we will hopefully have the opportunity to combine gravitational wave measurements with electromagnetic emission. I will describe theoretical work to help interpret these observations, and provide even better measurements of white dwarf tides.

Author: PIRO, Anthony (Carnegie Observatories)

Presenter: PIRO, Anthony (Carnegie Observatories)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **5** Type: **Talk**

Evolving R Coronae Borealis Stars with MESA

Friday 5 July 2019 10:30 (20 minutes)

The R Coronae Borealis (RCB) stars are rare hydrogen-deficient, carbon-rich supergiants. They undergo extreme, irregular declines in brightness of many magnitudes due to the formation of thick clouds of carbon dust. Two scenarios have been proposed for the origin of an RCB star: the merger of a CO/He white dwarf (WD) binary and a final helium-shell flash. We constructed post-merger spherical models based on merger progenitor structures computed with the MESA code, and then followed the evolution into the region of the HR diagram where the RCB stars are located. We also investigated nucleosynthesis in the dynamically accreting material of CO/He WD mergers which may provide a suitable environment for significant production of ^{18}O and the very low ^{16}O/^{18}O values observed. Our MESA modeling consists of engineering the star by adding He-WD material to an initial CO-WD model, and then following the post-merger evolution using a nuclear-reaction network to match the observed RCB abundances as it expands and cools to become an RCB star. These new models are more physical because they include rotation, mixing, mass-loss, and nucleosynthesis within MESA. We follow the later evolution beyond the RCB phase to determine the stars' likely lifetimes. The relative numbers of known RCB and Extreme Helium (EHe) stars correspond well to the lifetimes predicted from the MESA models. In addition, most of computed abundances agree very well with the observed range of abundances for the RCB class.

Author: CHATZOPOULOS, Emmanouil (Louisiana State University)

Presenter: CHATZOPOULOS, Emmanouil (Louisiana State University)

Session Classification: Mergers

Contribution ID: **6** Type: **Talk**

The Origin of Standard Thermonuclear Supernovae from Hybrid White Dwarf Mergers

Thursday 4 July 2019 11:30 (20 minutes)

Type-Ia supernovae (SNe) are thought to originate from the thermonuclear explosions of carbon-oxygen (CO) white-dwarf (WD) stars. The proposed progenitors of standard type Ia-SNe can be generally divided between explosions of CO-WDs accreting material from stellar non-degenerate companions (single-degenerate; SD models), and those arising from the mergers of two CO-WDs (double-degenerate; DD models). However, the suggested models for the progenitors of such SNe fail to reproduce the diverse properties of the observed explosions, and they do not explain the inferred rates and the characteristics of the observed populations of type Ia-SNe. Here we use detailed thermonuclear-hydro dynamical and radiative-transfer models to show that mergers of CO-WDs with hybrid CO-He WDs provide a viable model for standard-candle Ia-SNe. We find that such mergers give rise to explosions that recreate the detailed light-curves and spectra of Ia-SNe, and in particular reproduce the full range of the width-luminosity Phillips relation observed for standard-candle SNe. Moreover, our population synthesis models show that the rate and delay-time distribution of such mergers are consistent with observations of standard candle type-Ia SNe. Such successful models for type Ia-SNe can, therefore, serve to study the detailed composition yields from SNe, and the systematics involved in Ia-SNe measurements of the cosmological parameters of the universe

Author: Mr ZENATI, Yossef (Technion)

Co-authors: Prof. PERETS, Hagai (Technion); Prof. TOONEN, Silvia

Presenter: Mr ZENATI, Yossef (Technion)

Session Classification: Supernovae & their Aftermath

Contribution ID: **7** Type: **Talk**

A white dwarf with an usual composition as a possible product of a binary merger

Friday 5 July 2019 11:30 (20 minutes)

The merger of two white dwarfs with a combined mass below the Chandrasekhar-limit is expected to be non-explosive, resulting in a single massive white dwarf. However, because single star evolution can also produce massive white dwarfs, few known degenerate stars have categorically been confirmed as merger products.

We report the identification of a 1.15 $M_{\odot}$ white dwarf with a unique photospheric composition which is not explained through standard models of single star evolution. The stellar atmosphere is dominated by hydrogen, but with a C/H ratio of 0.15. The spectroscopic non-detection of helium and maximum convection zone mass of $M_{\rm cvz}/M_{\rm wd} = 10^{-10}$, imply an extremely small stellar envelope with a remarkably low helium fraction (considering the dredge up carbon from the interior). This new discovery potentially provides a new avenue to investigate a rare channel of binary-star evolution.

Author: Dr HOLLANDS, Mark (The University of Warwick)

Co-authors: Dr TREMBLAY, Pier-Emmanuel (The University of Warwick); Prof. GAENSICKE, Boris (The University of Warwick); Prof. KOESTER, Detlev (University of Kiel); Dr GENTILE-FUSILLO, Nicola (The University of Warwick); Ms IZQUIERDO, Paula (IAC); Mr HOSKIN, Matthew (The University of Warwick); Dr CHOTE, Paul (The University of Warwick); Dr STEEGHS, Danny (The University of Warwick)

Presenter: Dr HOLLANDS, Mark (The University of Warwick)

Session Classification: Mergers

Contribution ID: **9** Type: **Talk**

Finding compact binaries with KPED

Tuesday 2 July 2019 11:30 (20 minutes)

The Kitt Peak Electron Multiplying CCD (EMCCD) demonstrator is a new instrument that has been developed for use at the Kitt Peak National Observatory's 84-inch telescope. With frame rates greater than 1 Hz possible and a field-of-view of 4.4′ × 4.4,′ this camera, coupled with a fully roboticized telescope, it is ideal for follow-up of short period, white dwarf binary candidates, as well as short duration transient and periodic sources identified by large field-of-view all-sky surveys such as the Zwicky Transient Facility. We will discuss this system and its synergy with ZTF, including its high-cadence observation of select Galactic fields and moderate cadence observations of a 3000 square degree field at higher declination. We will describe how we are systematically following up and confirming periodic sources identified in ZTF data, and will highlight some of the binaries that have been found.

Authors: Dr COUGHLIN, Michael; Mr BURDGE, Kevin (California Institute of Technology); Mr KULKARNI, Shri (California Institute of Technology); Dr PRINCE, Thomas (California Institute of Technology); Dr VAN ROESTEL, Joannes (California Institute of Technology)

Presenter: Dr COUGHLIN, Michael

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **11** Type: **Talk**

The double-degenerate model for the progenitors of SNe Ia

Type Ia supervovae (SNe Ia) have been successfully employed as standard cosmological distance indicators. It has been found that the Universe is expanding at an increasing rate through the observation of SNe Ia, which reveals the existence of dark energy. However, the progenitors of SNe Ia are still unclear, which may affect the accuracy of the mearsured distance. Recently, both observational and some theoritical studies slightly favor the double-degenerate model, in which the merging of double Carbon-Oxygen white dwarfs (CO WDs) would produce SNe Ia as their total mass is larger than the Chandrasekhar limit. In this talk, I will introduce the proposed CO WD+He subgiant channel for producing SNe Ia based on the double degenerate model. Previous studies on the double-degenerate model still have deficit with the observed SNe Ia with ages less than 1 Gyr and longer than 8 Gyr. After considering the WD+He subgiant channel, we found that the distributions of the predicted SN Ia ages is comparable with the observed results. I will also introduce our recent studies on the formation of SNe Ia from the violent mergers of double CO WD and the merging of CO WD+hybrid HeCO WD systems.

Author: LIU, Dongdong

Presenter: LIU, Dongdong

Session Classification: Supernovae & their Aftermath

Contribution ID: **12** Type: **Talk**

The Role of Dredge-up in Double White Dwarf Mergers

Friday 5 July 2019 10:10 (20 minutes)

We present the results of an investigation of the dredge-up and mixing during the merger of two white dwarfs (WDs) with different chemical compositions by conducting hydrodynamic simulations of binary mergers for three representative mass ratios. In all the simulations, the total mass of the two WDs is $1.0\mathrm{M}$. Mergers involving a CO and a He WD have been suggested as a possible formation channel for R Coronae Borealis (RCB)-type stars, and we are interested in testing if such mergers lead to conditions and outcomes in agreement with observations. Even if the conditions during the merger and subsequent nucleosynthesis favor the production of ^{18}O, the merger must avoid dredging up large amounts of ^{16}O, or else it will be difficult to produce sufficient ^{18}O to explain the oxygen ratio observed to be of order unity. We performed a total of nine simulations using two different grid-based hydrodynamics codes using fixed and adaptive meshes and one smooth particle hydrodynamics (SPH) code. We find that in most of the simulations, $> 10^{-2}M$ of ^{16}O is indeed dredged up during the merger. However, in SPH simulations where the accretor is a hybrid He/CO WD with a $0.1M$ layer of helium on top, we find that no ^{16}O is being dredged up, while in the q = 0.8 simulation $< 10^{-4}\mathrm{M}$ of ^{16}O has been brought up, making a WD binary consisting of a hybrid CO/He WD and a companion He WD an excellent candidate for the progenitor of RCB stars.

Authors: STAFF, Jan (University of the Virgin Islands); Prof. WIGGINS, Brandon (Southern Utah University); Dr MARCELLO, Dominic (Louisiana State University); Prof. MOTL, Patrick (Indiana University Kokomo); Dr EVEN, Wesley (Los Alamos National Lab); Dr FRYER, Chris (Los Alamos National Laboratory); Dr RASKIN, Cody (Lawrence Livermore National Laboratory); Prof. CLAYTON, Geoffrey (Louisiana State University); Prof. FRANK, Juhan (Louisiana State University)

Presenter: STAFF, Jan (University of the Virgin Islands)

Session Classification: Mergers

Contribution ID: **13** Type: **Talk**

Constraining Galactic structure with the LISA white dwarf foreground

Tuesday 2 July 2019 15:00 (20 minutes)

White dwarfs (WDs) comprise 95% of all stellar remnants and are thus a unique probe of the ancient structure of the Milky Way. Current and planned telescopes aren't able to directly probe the entire population due to its inherently low luminosity. However, the Galactic population of double WD binaries gives rise to a strong millihertz gravitational-wave foreground detectable by LISA. Here we show how characterizing this foreground will enable us to probe the Galactic structure in a novel way and measure the scale height of the Galaxy. We do this using a binary population synthesis study that incorporates age and metallicity-dependent Galactic spatial distributions of the double WDs.

Authors: Dr BREIVIK, Katelyn (CITA); Dr LARSON, Shane L. (CIERA - Northwestern University); Dr MINGARELLI, Chiara M. F. (Flatiron Institute)

Presenter: Dr BREIVIK, Katelyn (CITA)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **14** Type: **Talk**

Do sub-Chandrasekhar mass white dwarf explosions occur in nature?

Thursday 4 July 2019 14:20 (20 minutes)

Carbon-oxygen WDs accreting a helium shell have the potential to explode in the sub-Chandrasekhar mass regime through the double detonation scenario, when a helium shell ignition propagates a shock wave into the the core of the WD causing a central ignition. I will present the results of a recent numerical parameter survey of hydrodynamic and radiative transport models of sub-Chandrasekhar mass white dwarf explosions. I examine a relationship between SiII velocity and luminosity which, for the first time, identifies a sub-class of observed supernovae that are consistent with these models. I will show the distinct observational signatures of sub-Chandrasekhar mass WD explosions predicted for early time, peak and nebular observations. I will also discuss the discovery of the peculiar Type I supernova, SN2018byg: the first observed sub-Chandrasekhar mass mass white dwarf explosion triggered by the ignition of a massive helium shell.

Author: POLIN, Abigail (UC Berkeley)

Co-authors: Prof. KASEN, Daniel (UC Berkeley); Dr NUGENT, Peter (Lawrence Berkeley National Laboratory)

Presenter: POLIN, Abigail (UC Berkeley)

Session Classification: Supernovae & their Aftermath

Contribution ID: **15** Type: **Talk**

Three-Dimensional Simulations of White Dwarf Mergers and Turbulently-Driven Detonation Initiation

Thursday 4 July 2019 14:00 (20 minutes)

While the stellar progenitors of Type Ia supernovae (SNe Ia) remain a subject of active investigation, recent multi-wavelength observations of SNe Ia have tightly constrained near-Chandrasekhar mass (near-Mch) single-degenerate (SD) SNe Ia. In particular, the most extensive set of non-detections of nebular H-alpha from SNe Ia of 110 events of all classes (Tucker et al, 2019) guide us to seriously consider white dwarf mergers as the origin not only of normal SNe Ia, but also of SNe Ia types previously considered to originate from SDs – ranging from underluminous SNe Iax to bright 91Ts.

In this talk, I will present the first three-dimensional simulations of CO and ONe WD mergers and demonstrate that these may lead to very faint, rapid transients with possible connections to SNe Iax. Additionally, I will also present new three-dimensional simulations of CO WD binaries with thin He layers, and explore whether surface He detonations yield detonations of the underlying CO primary cores. Lastly, I will discuss new physical insights into the crucial physical process of turbulently-driven detonation initiation, which underlies all major SNe Ia channels.

Author: FISHER, Robert (University of Massachusetts Dartmouth)

Presenter: FISHER, Robert (University of Massachusetts Dartmouth)

Session Classification: Supernovae & their Aftermath

Contribution ID: **16** Type: **Talk**

Quantification of the effects of unresolved double-degenerates in the white dwarf luminosity function

Wednesday 3 July 2019 09:30 (20 minutes)

The white dwarf luminosity function is an essential tool to understand the nature and the history of the different components of our Galaxy. However, observational white dwarf samples from which the luminosity functions are built are contaminated by unresolved double-degenerates. These systems are considered as 'single' white dwarfs from an observational point of view and therefore contribute with unreliable information to the luminosity function. In this work we quantify the effects of unresolved double-degenerates in the white dwarf luminosity function by means of detailed population synthesis studies.

Author: Dr REBASSA-MANSERGAS, Alberto (Universitat Politècnica de Catalunya)

Co-authors: Prof. TOONEN, Silvia; Dr TORRES, Santiago

Presenter: Dr REBASSA-MANSERGAS, Alberto (Universitat Politècnica de Catalunya)

Session Classification: Observed WD Populations 2

Contribution ID: **17** Type: **Talk**

The Shortest Period Eclipsing Binary

Tuesday 2 July 2019 10:25 (20 minutes)

Here we give new updates on an eclipsing double white dwarf binary with an orbital period of only 6.9 minutes. Additionally, we highlight several other candidate LISA DWD sources discovered using the optical time domain and discuss the future of this class of sources in the era of surveys such as LSST.

Author: BURDGE, Kevin (California Institute of Technology)

Co-authors: Prof. FULLER, Jim; Dr VAN ROESTEL, Joannes (California Institute of Technology); COUGHLIN, Michael (California Institute of Technology); Mr KULKARNI, Shri (California Institute of Technology); Dr KUPFER, Thomas; Dr PRINCE, Thomas (California Institute of Technology)

Presenter: BURDGE, Kevin (California Institute of Technology)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **18** Type: **Talk**

Energy budget and drag force in 3D global AMR simulations of common envelope evolution

Monday 1 July 2019 14:20 (20 minutes)

Common envelope evolution (CEE) is presently a poorly understood, yet critical, process in binary stellar evolution. I present results from a suite of high resolution global 3D hydrodynamical adaptive mesh refinement simulations of CEE involving a red giant branch or asymptotic giant branch primary and a white dwarf or main sequence secondary. The simulations are analyzed to understand how energy is transferred between various forms to unbind the envelope. I show that simulation results and theory based on the $\alpha_{\rm CE}$ energy formalism are mutually consistent, in spite of the fact that no CEE simulation to date has succeeded in completely ejecting the envelope without including extra energy sources. I argue for an alternative framing of the problem which more cleanly separates the energy of secondary and primary core particles from that of gas, thereby facilitating analysis. The forces resulting from the gravitational interaction between gas and core particles are also analyzed. It is found that the gas dynamical friction force on the secondary, which is responsible for loss of orbital energy, is much smaller than what is expected from Bondi-Hoyle-Lyttleton theory. This is a consequence of a strong non-axisymmetric perturbation on the gravitational potential caused by spiral tidal wakes emanating from the core particles.

Authors: Dr CHAMANDY, Luke (University of Rochester); Prof. BLACKMAN, Eric (University of Rochester); Prof. FRANK, Adam (University of Rochester); Mr TU, Yisheng (University of Rochester); Dr CARROLL-NELLENBACK, Jonathan (University of Rochester); Dr LIU, Baowei (University of Rochester); Prof. NORDHAUS, Jason (Rochester Institute of Technology)

Presenter: Dr CHAMANDY, Luke (University of Rochester)

Session Classification: Observed WD Populations 1

Contribution ID: **19** Type: **Talk**

Accreting White Dwarf Binaries as Gravitational Wave Sources

Tuesday 2 July 2019 14:20 (20 minutes)

Compact white dwarf (WD) binaries are expected to be the most abundant source detected by the upcoming gravitational-wave observatory, LISA. Based on both observational indications and theoretical studies, a fraction of these close WD binaries are expected to be undergoing mass transfer. The nature of this mass transfer will determine the long-term survival of the systems and will have important implications for the associated gravitational wave signals. In this talk, I will discuss the gravitational wave signals of binaries undergoing mass transfer from a WD donor onto both WD and neutron star accretors. I will also briefly discuss ways these close WD binaries may form dynamically in dense star clusters.

Author: KREMER, Kyle (CIERA-Northwestern)

Co-authors: KATIE, Breivik (CITA); KALOGERA, Vicky (CIERA-Northwestern); RASIO, Fred (CIERA-Northwestern)

Presenter: KREMER, Kyle (CIERA-Northwestern)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **20** Type: **Talk**

Collisions of two white dwarfs and the associated nucleosynthesis

Thursday 4 July 2019 14:40 (20 minutes)

Traditionally it has been assumed that the collision of two white dwarfs was a low probability event confined to the surroundings of the Galactic centre or to the core of globular clusters. Depending on the nature of the two stars (mass and chemical composition) and on the parameters of the collision (relative velocity and impact parameter) the outcome of the encounter can go from a simple tidal stripping of the white dwarf matter, to a true thermonuclear explosion that can be assimilated to some Type Ia supernova subtype. In general, the ejected mass will consist on completely and partially burned material and pristine mass of the white dwarf. The frequency at which they can occur is still a matter of debate and, consequently, their contribution to the galactic chemical evolution uncertain. However, the recent realization that hierarchical triple and quadruple systems can provide an adequate additional scenario for such encounters, shows that these events can occur anywhere in the Galaxy and, in particular, in the solar neighbourhood.

The pristine material, that globally has the chemical composition that results from the hydrostatic H and He-burning, can have local peculiar isotopic compositions caused by the sedimentation processes occurring inside the white dwarfs during their cooling. If these peculiarities are retained via the formation of dust grains and their inclusion in protostellar nebulae, they could account for the existence of some meteoritic anomalies similar to those found in the Solar System.

Authors: Prof. ISERN, Jordi (ICE,CSIC/IEEC); Prof. BRAVO, Eduardo (UPC)

Presenter: Prof. ISERN, Jordi (ICE,CSIC/IEEC)

Session Classification: Supernovae & their Aftermath

Contribution ID: **21** Type: **Talk**

Characterizing the local double white dwarf population

Monday 1 July 2019 11:35 (20 minutes)

The characterization of the local double white dwarf (DWD) population is crucial to our understanding of multiple questions, from stellar evolution, through the progenitors of Type-Ia supernovae (SNe Ia), to gravitational wave sources. From a spectroscopic sample of 439 WDs from the SPY survey, we measure the maximal changes in radial-velocity (DRVmax) between epochs, and model the observed DRVmax statistics via Monte-Carlo simulations, to constrain the population characteristics of DWDs. We then combine the results with those of a complementary sample from the SDSS to obtain new and precise information on the DWD population and on its gravitational-wave-driven merger rate. We find that ~10% of WDs are in DWD systems in the separation range ~<4 AU within which the data are sensitive to binarity. The Galactic WD merger rate per WD is ~1e-11 per year. Integrated over the Galaxy lifetime, this implies that 8.5-11% of all WDs ever formed have merged with another WD. If most DWD mergers end as more-massive WDs, then some ~10% of WDs are DWD-merger products. The implied Galactic DWD merger rate is 4.5-7 times the Milky Way's specific SN Ia rate. If most SN Ia explosions come about from the mergers of some DWDs then ~15% of all WD mergers must lead to a SN Ia.

Authors: HALLAKOUN, Na'ama (Tel-Aviv University); Prof. MAOZ, Dan (Tel-Aviv University)

Presenter: HALLAKOUN, Na'ama (Tel-Aviv University)

Session Classification: Observed WD Populations 1

Contribution ID: **22** Type: **Talk**

Double White Dwarfs and the Incidence of Magnetism

Wednesday 3 July 2019 09:50 (20 minutes)

About 10% of white dwarfs in the solar neighborhood are strongly magnetic, with field strengths of up to 1000 MG. Curiously, high field magnetic white dwarfs are never found in wide binary systems with late-type stellar companions. This suggests that merging binaries within a common envelope may be required to explain the incidence of magnetism in these objects. However, there are also several high field magnetic white dwarfs known or suspected to be in common proper motion or short period binaries with other white dwarfs. I will present an overview of these systems, and also present time-series spectroscopic observations of an intriguing binary candidate.

Author: KILIC, Mukremin (University of Oklahoma)

Presenter: KILIC, Mukremin (University of Oklahoma)

Session Classification: Observed WD Populations 2

Contribution ID: **23** Type: **Poster**

Properties of the mass stream–accreting matter interaction in two Double White Dwarfs

Tuesday 2 July 2019 15:20 (45 minutes)

We study the physical properties of the interacting processes between the components of two double white dwarf binary stars, V803 Cen and CR Boo, depending on the evolutionary stages for each of the two targets, separately. Both objects are semi-detached binaries, influenced by the mass transfer mechanism. The initial conditions suggest disturbances in the flow parameters, followed by instabilities in the mass transfer. The resulting flow morphology in the interacting area, where the stream from the secondary meets the initial accreting matter onto the primary is examined. As a result, we expect for an unstable accretion disc configuration or non-disc formation to be obtained. In presumptive relation to the two targets activity, we have checked their observational data. We have found the brightness variations in the light curves of both objects for different periods.

Author: BONEVA, Daniela (Space Research and Technology Institute, BAS)

Presenter: BONEVA, Daniela (Space Research and Technology Institute, BAS)

Session Classification: Posters

Contribution ID: **25** Type: **Poster**

White dwarf-neutron star binary progenitors for ultra-compact X-ray binaries

Tuesday 2 July 2019 15:20 (45 minutes)

White dwarf-neutron star binaries are among the main progenitors for ultra-compact X-ray binaries. They spiral in to contact by emitting gravitational waves and depending on the mass of the white dwarf turn into stably transferring ultra-compact X-ray binaries or produce supernova-like events following a tidal disruption of the white dwarf. Nearly all the stably transferring systems evolve through a phase during which mass transfer rates exceed the Eddington rate by orders of magnitude. The standard prescription for population synthesis codes assumes that during this phase all the excess material is lost from the system through a tightly collimated jet originating at the accretor. This is in contrast to observations of systems accreting at highly super-Eddington rates, such as SS 433, which are characterised by significant outflows from the accretion disc. To assess the role of such disc outflows, we perform hydrodynamic simulations of super-Eddington accretion in white dwarf-neutron star binaries. We measure the specific angular momentum lost through disc winds in our simulations and find that it is significantly larger than the angular momentum carried away through a jet. We use the measured angular momentum to construct a model of the long-term evolution of white dwarf-neutron star binaries and predict the outcomes of mass transfer. We find that more binaries result in unstable mass transfer than previously thought. In particular, all the binaries with CO white dwarfs and He white dwarfs more massive than about 0.2 solar masses, which were assumed to be stable, were found to be unstable. This result leads to a better agreement between the empirical inspiral rates of binary pulsars containing white dwarfs and empirical formation rates and compositions of ultra-compact X-ray binaries in the Galaxy.

Author: BOBRICK, Alexey (Lund University)

Co-authors: DAVIES, Melvyn B. (Lund University); CHURCH, Ross (Lund University)

Presenter: BOBRICK, Alexey (Lund University)

Session Classification: Posters

Contribution ID: **26** Type: **not specified**

Double white dwarf merger remnants as low frequency gravitational wave sources

Friday 5 July 2019 12:10 (20 minutes)

We propose a new category of low frequency gravitational wave sources related to mergers of double white dwarfs. A remnant just after a merger is a rapidly and differentially rotating objects, which may develop non-axisymmetric instability of hydrodynamical origin. If the remnant is susceptible to the so-called 'low T/W' instability, m=2 (bar) or m=1 (spiral) density pattern may develop (here m is the azimuthal quantum number of perturbation) and the mass quadrupole may oscillate with a typical frequency of O[0.1-1] Hz. We discuss the detectability of newly-born remnants by the planned spaceborne gravitational wave observatories targeting intermediate frequency range such as DECIGO, Big Bang Observer, and TianQin.

Author: Dr YOSHIDA, Shin (The University of Tokyo)

Presenter: Dr YOSHIDA, Shin (The University of Tokyo)

Session Classification: Mergers

Contribution ID: **28** Type: **Talk**

ELM Survey: the Observed Distribution of He+CO binaries

Monday 1 July 2019 11:55 (20 minutes)

We present the completed ELM Survey, a targeted survey of extremely low mass white dwarfs. The final sample contains 106 He+CO white dwarf binaries; their median orbital period is 6 hr. Combining our spectroscopy with Gaia astrometry reveals that half of the binaries orbit in the disk, half in the halo. We compare the disk and halo samples, and discuss the merger rate of He+CO white dwarf binaries in the Milky Way. Our shortest orbital period systems are among the strongest LISA verification binaries.

Author: BROWN, Warren (Smithsonian)

Co-author: KILIC, Mukremin (University of Oklahoma)

Presenter: BROWN, Warren (Smithsonian)

Session Classification: Observed WD Populations 1

Contribution ID: **29** Type: **Talk**

Runaway White Dwarfs after Shocks from Supernova Ejecta

Thursday 4 July 2019 11:50 (20 minutes)

In the D6 scenario for Type Ia supernovae, the lower mass white dwarf is in a close orbit while donating material to its companion that explodes as a supernova. This orbit leads to the high velocities of runaway stars thought to be candidate white dwarf donor remnants from D6 systems. It also implies that the donor star should experience significant interaction with the supernova ejecta, which may be necessary to explain the brightness and expanded radius of candidate remnant objects. We explore the long-term consequences of such interaction using MESA models. After injecting an entropy profile based on hydrodynamical Athena++ models, we follow the subsequent hydrostatic evolution of these models over longer timescales to explore whether this entropy can explain current observed states of candidate objects.

Author: BAUER, Evan (UC Santa Barbara)

Co-authors: COLEMAN, Matthew (Institute for Advanced Study); WHITE, Christopher (Kavli Institute for Theoretical Physics); Prof. BILDSTEN, Lars (Kavli Institute for Theoretical Physics)

Presenter: BAUER, Evan (UC Santa Barbara)

Session Classification: Supernovae & their Aftermath

Contribution ID: **30** Type: **Talk**

New observational constraints on the merger rate of double white dwarfs in triple systems

Wednesday 3 July 2019 11:55 (20 minutes)

Despite the importance today of Type Ia supernova explosions (SNe Ia) for a number of branches of astrophysics and cosmology, their progenitors and exact explosion mechanism remain unclear. The two standard scenarios for SNe Ia explosions, single-degenerate accretion and double-degenerate mergers, both have a number of theoretical and observational challenges, and there is still no consensus on the relative importance of each channel. I will present ongoing observational work on the statistics and properties of hierarchical triple systems that is aimed at constraining the relative importance of these objects as a potential third candidate for SNe Ia progenitors. Our preliminary results are already suggesting that such triples may indeed be an important contributor to the observed SNe Ia rate, and would also provide a clean explanation for the existence of a sizeable fraction of merged white dwarfs as recently suggested by Gaia.

Author: CHANAMÉ, Julio (Pontificia Universidad Católica de Chile)

Presenter: CHANAMÉ, Julio (Pontificia Universidad Católica de Chile)

Session Classification: Observed WD Populations 2

Contribution ID: **31** Type: **Talk**

Hydrodynamic Evolution of Supernovae Impacting White Dwarf Donors

Thursday 4 July 2019 12:10 (20 minutes)

The D6 scenario suggests that the white dwarf donor interacts significantly with the supernova ejecta, as a way to explain the luminosity and size of candidate remnant objects. As this is clearly a dynamical interaction, we use the self-gravity and newly developed EOS capabilities of Athena++ to explicitly evolve the hydrodynamical phase of the ejecta-donor interaction, with particular attention dedicated to the shock that travels through the donor and the entropy deposited in its interior.

Author: COLEMAN, Matthew (Institute for Advanced Study)

Co-authors: BAUER, Evan (UC Santa Barbara); WHITE, Christopher (Kavli Institute for Theoretical Physics); Prof. BILDSTEN, Lars (Kavli Institute for Theoretical Physics)

Presenter: COLEMAN, Matthew (Institute for Advanced Study)

Session Classification: Supernovae & their Aftermath

Contribution ID: **32** Type: **Talk**

The Fastest Stars in the Galaxy: Confirmation of the D6 Type Ia Supernova Scenario

Thursday 4 July 2019 09:30 (35 minutes)

The binary companion and mechanism responsible for triggering the explosion of a white dwarf (WD) as a Type Ia supernova (SN Ia) have been the subject of intense research for decades. In the "dynamically driven double-degenerate double-detonation"(D6) scenario, the binary companion is another WD that begins to undergo unstable mass transfer. The violence of this dynamical accretion leads to a helium detonation on the primary WD's surface that then triggers a carbon core detonation and subsequent SN Ia. One possible outcome of the D6 model is that the secondary WD survives the explosion and flies away from the SN Ia site with its pre-explosion orbital velocity of > 1000 km/s. We performed a search for such hypervelocity runaway WDs in Gaia's second data release and found three very intriguing stars whose characteristics, derived from follow-up observations, match many of the predictions of the D6 model. These potential D6 survivors are the strongest evidence to date of a successful SN Ia progenitor scenario, and future work may confirm the hypothesis that the D6 model is responsible for the majority of all SNe Ia.

Author: SHEN, Ken (UC Berkeley)

Presenter: SHEN, Ken (UC Berkeley)

Session Classification: Supernovae & their Aftermath

Contribution ID: **34** Type: **Talk**

Population synthesis study of the Gaia binary white dwarf population within 100 pc

Monday 1 July 2019 14:40 (20 minutes)

Gaia-DR2 has provided an unprecedented wealth of information about the white dwarf population of our Galaxy. In particular, our estimates show that the sample up to 100 pc from the Sun can be considered as practically complete. This fact permits to obtain accurate statistics about the percentages of the different subpopulations, such as the number of resolved/unresolved double degenerate systems, or white dwarf plus main sequence stars. With the aid of a detailed population synthesis code we are able to fit the best models parameters thus obtaining valuable information about the initial separation distribution, the binary fraction or the initial mass and ratio distribution, among others.

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Presenter: Dr TORRES, Santiago (Universitat Politècnica de Catalunya (UPC), Spain)

Session Classification: Observed WD Populations 1

Contribution ID: **35** Type: **Talk**

The evolutionary history of AM CVn binaries

Tuesday 2 July 2019 14:00 (20 minutes)

AM CVn stars are ultracompact, accreting binaries in which both stars are either degenerate or semi-degenerate. Several formation channels have been suggested for AM CVn binaries, including a favoured model in which they descend directly from double white dwarf binaries. The double white dwarf channel has uncertainties around the fraction of double degenerate binaries which will reach a state of stable accretion versus those that will merge. Historic observations of the composition of the accreted material have favoured the double white dwarf channel as a prominent source of AM CVn binaries. On the other hand, recent observations seem to challenge current models of the double white dwarf channel. These observations include donor mass measurements (especially from eclipsing systems) and absolute magnitude measurements from Gaia. Both sets of observations suggest that the donors in AM CVn binaries are more inflated than is predicted by current models of the double degenerate channel. I will present an overview of these results and discuss future work that might help to unveil these mysteries.

Author: GREEN, Matthew (University of Warwick)

Presenter: GREEN, Matthew (University of Warwick)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **36** Type: **Talk**

Uncovering the population of eclipsing double white dwarfs with ZTF

Tuesday 2 July 2019 10:05 (20 minutes)

The Zwicky Transient Facility (ZTF) is in the process of obtaining well sampled lightcurves of all stars in the Northern hemisphere. In this sample of billions of lightcurves, we can expect to find on the order of a hundred eclipsing double white dwarfs. We are in the process of systematically searching the ZTF lightcurve for these systems, both by doing targeted searches as well a general search using machine learning classifiers. Initial results are promising; we have detected a handful of eclipsing systems and sensitive to cooler and more compact eclipsing double white dwarfs that have currently been found. I will present an overview of our search for eclipsing double white dwarf in ZTF data, present the eclipsing double white dwarf systems found so far, and discuss how ZTF can be used to study the population of double white dwarfs.

Author: VAN ROESTEL, Joannes (California Institute of Technology)

Co-authors: COUGHLIN, Michael (California Institute of Technology); BURDGE, Kevin (California Institute of Technology); Dr KUPFER, Thomas; Dr PRINCE, Thomas (California Institute of Technology)

Presenter: VAN ROESTEL, Joannes (California Institute of Technology)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **37** Type: **Talk**

Multi-messenger Galactic Astronomy with double white dwarfs

Tuesday 2 July 2019 14:40 (20 minutes)

The upcoming LISA mission is the only experiment that offers the opportunity to map the Milky Way through gravitational wave radiation, exploiting signals from double white dwarf (DWD) binaries. I will show that the large number of DWD detections will allow us to use these systems as tracers of the Milky Way's shape and to measure scale parameters of the bulge, disc and bar. Furthermore, in the coming years, a large number of DWDs can be simultaneously detected in both electromagnetic (e.g. with Gaia and LSST) and gravitational wave radiation. This will provide a unique opportunity to perform a multi-messenger study of the Galaxy. Finally, I will talk about the prospects of using GW signals from halo DWDs as a tool for detecting "invisible" satellites galaxies and stellar streams in the Milky Way outer halo.

Author: KOROL, Valeriya (Leiden Observatory)

Presenter: KOROL, Valeriya (Leiden Observatory)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **38** Type: **Poster**

Explore the Double Degenerate scenario using Phantom

Tuesday 2 July 2019 15:20 (45 minutes)

The double-degenerate scenario is, nowadays, the preferred model to explain the majority of Type Ia supernovae. In order to explore it, a vast number of studies have been performed during the last decades using a large variety of methods. From the theoretical point of view, numerical simulations using the Smoothed Particle Hydrodynamics (SPH) method have played an essential role understanding the dynamical behaviour of merging white dwarfs. Various different groups have performed SPH simulations of the double-degenerate scenario, using in the vast majority of the cases their own fine-tuned for the purpose SPH codes. Unfortunately, the majority of those codes have remained private, falling some of them into oblivion or obsolescence. As a result, the community lacks a reliable, up to date, open-source, designed-for-the-purpose SPH code that can perform simulations of white dwarf binary mergers. In this work, we present an adaptation of the open-source SPH code phantom (Price et al. 2017) that allows the simulation of white dwarf binary mergers using a modern and robust SPH prescription.

Authors: Mr BLANCO-IGLESIAS, Jose Miguel (Universitat Politecnica de Catalunya (Spain)); Dr LOREN-AGUILAR, Pablo (University of Exeter); Prof. PRICE, Daniel (Monash University)

Presenter: Dr LOREN-AGUILAR, Pablo (University of Exeter)

Session Classification: Posters

Contribution ID: **39** Type: **Talk**

The Long-Lived Remnants of Massive White Dwarf Mergers

Friday 5 July 2019 09:30 (20 minutes)

The merger of carbon-oxygen or oxygen-neon white dwarfs need not lead to a thermonuclear explosion, even when their total mass is in excess of the Chandrasekhar mass. I will discuss the post-merger evolution of these massive merger remnants, which may sometimes result in the production of a neutron star, and draw parallels to ultra-stripped core collapse supernovae. I will also describe the observational signatures that may allow such objects to be identified in the Milky Way or nearby galaxies.

Author: SCHWAB, Josiah (UC Santa Cruz)

Presenter: SCHWAB, Josiah (UC Santa Cruz)

Session Classification: Mergers

Contribution ID: **40** Type: **Talk**

Close Double White Dwarfs from Gaia

Monday 1 July 2019 11:00 (35 minutes)

I will report on a programme of double white dwarf discovery from targets selected from Gaia DR2 from their location in the H-R diagram. Targets are chosen from their location above the main white dwarf cooling sequence in terms of luminosity. This favours double white dwarfs with equal contributions from the two stars and a number of new systems have been discovered. These are of particular interest for their mass ratios which have long been problematic for close double white dwarfs. I will also discuss the known sample of double white dwarfs with reference to the Gaia DR2 H-R diagram.

Author: MARSH, Tom (University of Warwick)

Co-authors: Prof. NELEMANS, Gijs (Radboud University); Dr TOONEN, Silvia (University of Birmingham); Ms OUTMANI, Sabrina (University of Warwick); Mr CUNNINGHAM, Tim (University of Warwick); Dr BREEDT, Elme

Presenter: MARSH, Tom (University of Warwick)

Session Classification: Observed WD Populations 1

Contribution ID: **41** Type: **Talk**

Type-Ia supernovae from mergers of hybrid He-CO WDs and CO WDs

Thursday 4 July 2019 11:10 (20 minutes)

Type-Ia supernovae (SNe) are thought to originate from the thermonuclear explosions of carbon-oxygen (CO) white-dwarf (WD) stars. They produce most of the Iron-peak elements in the universe, and bright Ia-SNe serve as important "standard candle"cosmological distance-indicators. The proposed progenitors of standard type Ia-SNe had been studied for decades and can be generally divided between explosions of CO-WDs accreting material from stellar non-degenerate companions (single-degenerate; SD models), and those arising from the mergers of two CO-WDs (double-degenerate; DD models). However, current models for the progenitors of such SNe failed to reproduce the diverse properties of the observed explosions, nor did they explain the inferred rates and the characteristics of the observed populations of type Ia-SNe. Here we use detailed thermonuclear-hydrodynamical and radiative-transfer models to show that mergers of CO-WDs with *hybrid CO-He WDs* are a key ingredient for the origins of type Ia SNe. They provide a viable model for normal type Ia-SNe, as well as explain the origin of particular types of SNe such as Ca-rich SNe. We find that such mergers give rise to explosions that which synthetic light-curves and spectra resemble those of observed type Ia-SNe. Moreover, our population synthesis models show that the rate and delay-time distribution of such mergers are consistent with observations of normal type-Ia SNe. Such successful models for type Ia-SNe can, therefore, explain their origin, serve to study the detailed composition yields from SNe, and potentially probe the systematics involved in Ia-SNe measurements of the cosmological parameters of the universe.

Author: Prof. PERETS, Hagai (Technion)

Co-authors: ZENATI, Yossef (Technion- Israel); Prof. TOONEN, Silvia; Mr BOBRICK , Alexey (lUND uNIVERSITY)

Presenter: Prof. PERETS, Hagai (Technion)

Session Classification: Supernovae & their Aftermath

Contribution ID: **42** Type: **Talk**

A 0.3% measurement of orbital decay in the 12.75-min WD+WD J0651+2844

Tuesday 2 July 2019 11:50 (20 minutes)

I will present a refined measurement of orbital decay from gravitational radiation in the second-most compact detached stellar binary known, the eclipsing 12.75-min double white dwarf system J0651+2844. Based on more than 490 hr of ground-based photometry over a nearly 8-year baseline, we measure a shift in mid-eclipse times caused by an orbital decay that can constrain the orbital decay to better than 0.3%. Our measurement is slightly faster than but still 1.2-sigma consistent with pure gravitatational wave losses. Spin-up from tides is expected to accelerate orbital decay, but uncertainties in the component masses still dominates our estimate of predicted orbital decay. Our updated orbital period predicts a strong gravitational wave signature at 2.6136734171(99) mHz, making J0651+2844 an exceptionally clean and well-characterized verification binary for future space-based gravitational wave detectors like the Laser Interferometer Space Antenna.

Author: HERMES, JJ (Boston University)

Presenter: HERMES, JJ (Boston University)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **43** Type: **Talk**

Known double white dwarfs as LISA sources and the ZTF high-cadence Galactic Plane survey

Tuesday 2 July 2019 09:30 (35 minutes)

With the data release of Gaia DR2 we were able to derive, for the first time, realistic strain, SNR predictions for the known LISA verification binaries. In this talk I will discuss our approach and result. I will also present an overview and the survey strategy of the ZTF high-cadence Galactic Plane survey which aims to find short period variables at low Galactic latitudes.

Author: KUPFER, Thomas (Kavli Institute for Theoretical Physics/UC Santa Barbara)

Presenter: KUPFER, Thomas (Kavli Institute for Theoretical Physics/UC Santa Barbara)

Session Classification: Short-period Binaries & Gravitational Waves

Contribution ID: **44** Type: **Talk**

ELM WDs in Double Degenerates: Formation and the significance for LISA

Monday 1 July 2019 15:00 (20 minutes)

Extremely low-mass white dwarfs (ELM WDs) are helium WDs with a mass less than $\sim 0.30\ M_{\odot}$. Most ELM WDs are found in double degenerates (DDs) in the ELM Survey led by Brown and Kilic. These systems are supposed to be significant gravitational-wave (GW) sources in the mHz frequency. In this talk, I first systematically investigated the formation of ELM WDs in DDs by a combination of detailed binary evolution calculation and binary population synthesis, and then compared our results with the observations. Finally, I will explore the GW radiation of such systems and make a prediction for future space-based interferometric GW detectors. See the paper for more details.

Author: LI, Zhenwei (Yunnan Observatories, Chinese Academy of Science)

Co-authors: Prof. XUEFEI, Chen (Yunnan Observatories, Chinese Academy of Science); Dr HAI-LIANG, Chen (Yunnan Observatories, Chinese Academy of Science); Prof. ZHANWEN, Han (Yunnan Observatories, Chinese Academy of Science)

Presenter: LI, Zhenwei (Yunnan Observatories, Chinese Academy of Science)

Session Classification: Observed WD Populations 1

Contribution ID: **45** Type: **Poster**

The formation of close double white dwarfs

Tuesday 2 July 2019 15:20 (45 minutes)

Close double white dwarfs(CDWDs) are good tests for theories of binary evolution, potential progenitors of Type Ia supernovae, and important contributors of gravitational wave signal at low frequencies. We used a binary population synthesis code of a population of 1 million binaries to study the characteristics of CDWDs, the mass transfer stability criterion comes from adiabatic mass loss model of Ge et al.(2015). I found that the simulation results are in good agreement with the observed characteristics of 107 known double white dwarf binaries, especially the 19 double white dwarf binaries with known masses of both components.

Author: Dr LI, HuaJu (Yunnan Observatories)

Co-author: Prof. CHEN, XueFei (Yunnan Observatories)

Presenter: Dr LI, HuaJu (Yunnan Observatories)

Session Classification: Posters

Contribution ID: **46** Type: **Poster**

The structure of the common envelope in the CEW model for Type Ia supernova

Tuesday 2 July 2019 15:20 (45 minutes)

Context. Although Type Ia supernovae (SNe Ia) are so important in many astrophysical fields, their progenitor nature is still unclear. Recently, Meng&Podsiadlowski (MP17) developed a new version of the single-degenerate model, i.e. the common-envelope wind (CEW) model. However, this model is still under development and some problems are still open, e.g. what is the exact appearance of a system during the CE phase?
Aims. In this paper, we try to investigate these problems for a system with a massive CE.
Methods. We used a thermally pulsing asymptotic giant branch (TPAGB) star with a CO core of 0.976M_sun and an envelope of 0.6M_sun to represent the binary system approximately, where the effects of the companion gravity and the rotation of common envelope are imitated by modifying the gravity constant, and the energy from friction between the binary and the common envelope is simulated by an extra heating.
Results. For a thick envelope, the modified TPAGB star still looks like a canonical TPAGB star, but with a smaller radius and a higher effective temperature, and then a higher surface luminosity, which is derived from the fact that among the three effects, the companion gravity dominates the evolution of the system. We found that the mixing length at the position of the companion is higher than the local radius, which could imply a turbulence and a breakdown of mixing length theory around this region. We also noticed that the modified TPAGB star is more stable than the canonical TPAGB star and the CE density around the companion is significantly higher than that used in MP17, which could not be real and be derived from a spherical symmetry hypothesis on the structure and an assumption of hydrostatic equilibrium.
Conclusions. A more detailed hydrodynamic simulation is needed to give the exact appearance of the system during the CE phase in the future.

Authors: Mr SONG, Ren; Prof. MENG, Xiangcun

Presenter: Mr SONG, Ren

Session Classification: Posters

Contribution ID: **47** Type: **Talk**

Limits from Gaia on the population of collisional-triple SN Ia progenitors

Wednesday 3 July 2019 11:35 (20 minutes)

The collisional-triple SN Ia progenitor model posits that SNe Ia result from head-on collisions of binary white dwarfs (WDs), driven by dynamical perturbations by the tertiary stars in mild-hierarchical triple systems. To reproduce the Galactic SN Ia rate, some 30-55 per cent of all WDs would need to be in triple systems of a specific architecture. We test this scenario by searching the Gaia DR2 database for the postulated progenitor triples. Within a volume out to 120 pc, we search around Gaia-resolved double WDs with projected separations up to 300 au, for physical tertiary companions at projected separations out to 3000 au. At 120 pc, Gaia can detect faint low-mass tertiaries down to the bottom of the main sequence and to the coolest WDs. Around 27 double WDs, we identify zero tertiaries at such separations, setting a 95 per cent confidence upper limit of 11 per cent on the fraction of binary WDs that are part of mild hierarchical triples of the kind required by the model. To further explore the triple landscape, we search Gaia DR2 for tertiaries within 3000 au of unresolved double-WD candidates with separations of ~0.1-1 au, identified via radial-velocity variations in the SPY survey. We identify such wide tertiaries around four (i.e. 9%) among the 44 double-WD candidates in this sample. As only a fraction (likely ~10 per cent) of all WDs are in < 300 au WD binaries, the potential collisional-triple progenitor population appears to be at least an order of magnitude (and likely several) smaller than required by the model.

Authors: MAOZ, Dan (Tel Aviv University); Dr HALLAKOUN, Na'ama (Tel-Aviv University)

Presenter: MAOZ, Dan (Tel Aviv University)

Session Classification: Observed WD Populations 2

Contribution ID: **49** Type: **Talk**

High-Mass White Dwarfs in Gaia DR2: the Q Branch and Double-WD Mergers

Wednesday 3 July 2019 10:30 (20 minutes)

Recently, Gaia DR2 has revealed an enhancement of high-mass WDs on the H-R diagram, called the Q branch. The distribution of photometric ages and velocities of WDs around the branch suggest an extra cooling delay beyond current WD cooling models. To explore the properties of this delay, we statistically compare two age indicators – the dynamical age reflected by transverse velocity and the photometric ages calculated from WD cooling models – for more than one thousand high-mass WDs ($1.08 - 1.23\,\mathrm{M}_\odot$). We show that, in addition to crystallization and merger delays, an extra 8-Gyr cooling delay is required on the Q branch, which affects only about $7\,\%$ of high-mass WDs. $^{22}\mathrm{Ne}$ settling in previously-metal-rich double-WD merger products may account for this extra delay. Independent of the explanation for the Q branch, we also show that $20 \pm 6\,\%$ of high-mass WDs originate from double-WD mergers, corresponding to a merger rate of $(2.1 \pm 0.6) \times 10^{-14}\,\mathrm{M}_\odot^{-1}\,\mathrm{yr}^{-1}$ in our mass range. This is a direct observational constraint on the rate of double-WD mergers. In future, our method may be used to constrain the delay time distribution of double-WD mergers.

Authors: CHENG, Sihao (Johns Hopkins University); Dr CUMMINGS, Jeffrey (Johns Hopkins University); Prof. MÉNARD, Brice (Johns Hopkins University)

Presenter: CHENG, Sihao (Johns Hopkins University)

Session Classification: Observed WD Populations 2

Contribution ID: **50** Type: **Talk**

Stellar mergers

Wednesday 3 July 2019 10:10 (20 minutes)

There are several indications that stellar mergers are common outcomes of binary evolution. Mergers involving white dwarfs are linked to several classes of transients, such as supernova type, and may leave imprints in other observables as well, e.g. the WD mass distribution. The alleged excess of WDs with masses around 0.8solar masses has been linked to double white dwarf mergers. Here we present our results of a population synthesis study focused on stellar mergers. From a theoretical point of view, do we expect to see the imprint of double white dwarf mergers and other mergers on the WD mass distribution? And how about other demographics?

Authors: TOONEN, Silvia (University of Birmingham); Mr TEMMINK, Karel (Radboud University)

Presenter: Mr TEMMINK, Karel (Radboud University)

Session Classification: Observed WD Populations 2

Contribution ID: **51** Type: **Talk**

Towards a complete picture of white dwarf merger outcomes

Friday 5 July 2019 09:50 (20 minutes)

The final outcome of white dwarf mergers across the entire merger parameter space is still relatively uncertain. This is mainly because, as the evolutionary phases involved span several orders of magnitude in timescales, one needs different numerical approaches/codes such as smoothed-particle hydrodynamics (SPH), magnetohydrodynamics (MHD), and detailed stellar evolution for the dynamical merger, the viscous phase evolution and the long-term (thermal) evolution, respectively. I will describe results from the first step in our project to create a complete picture of the white dwarf merger products, namely analysis of our initial SPH grid of models. Our work includes studying the impact of improved initial conditions and nuclear burning during this dynamical phase. I will focus on the range of sub-Chandrasekhar white dwarf mergers which has been widely considered as providing promising progenitors for a significant subset of thermonuclear supernovae.

Authors: ISTRATE, Alina (Radboud University); Prof. JUSTHAM , Stephen (University of Amsterdam); Prof. DE MINK, Selma (University of Amsterdam); Prof. CHANG, Philip (University of Wisconsin-Milwaukee)

Presenter: ISTRATE, Alina (Radboud University)

Session Classification: Mergers

Contribution ID: **52** Type: **not specified**

Review of Double WD Formation Channels

Monday 1 July 2019 14:00 (20 minutes)

Presenter: BREIVIK, Katelyn (Canadian Institute for Theoretical Astrophysics)

Session Classification: Observed WD Populations 1

Contribution ID: **53** Type: **Talk**

Welcome

Monday 1 July 2019 10:30 (30 minutes)

The organizers welcome you to Copenhagen.

Contribution ID: **54** Type: **Poster**

Poster Advertisments

Thursday 4 July 2019 15:00 (15 minutes)

Session Classification: Supernovae & their Aftermath

Contribution ID: **55** Type: **Talk**

Conference Summary

Friday 5 July 2019 15:00 (15 minutes)