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The definition of time from astronomy to physics

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The definition of time was traditionally the domain of astronomers who determined the exact length of the (average) day. Combining observations and gravitational theory of the solar system, astronomers inferred in the 1920s that the Earth's rotation around its axis is not uniform. Physicists did not contribute to this rather complicated argument until the mid-1930s when they were able to detect irregular fluctuations in the rate of Earth's rotation. Astronomy continued to suggest a 'dynamic'basis for defining time, based on the motion of the Earth around the Sun as determined by celestial mechanics ('ephemeris time'). Magnetic resonance methods of atomic beams developed in the 1930s suggested a new basis for defining time, grounded in a physical phenomenon deemed uniform and highly stable theoretically and empirically, i.e. the frequency of transition between two energy levels in an atom. In the 1950s, while astronomers were working on the exact definition of the 'ephemeris second,'physicists and engineers constructed and improved the atomic clock. The physics-based definition had some clear metrological advantages over the 'ephemeris second'that allowed its acceptance as the basis for time in 1967, a mere seven years after the second was defined by the Earth's ephemeris. I will suggest the reasons for the quick change, pointing at connections between metrology and physics, and the adoption of a physical ideal in the latter.

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