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Liquid Metallic Hydrogen: Building Block of a Liquid Sun
PIERRE-MARIE ROBITAILLE, The Ohio State University — The establishment by Andrews of critical temperatures (T. Andrews, Phil. Trans. 1869, v. 159, 575-590) soon became one of the great pillars in support of the gaseous models of the Sun. Gases above these temperatures simply could not be liquefied. Given that interior of the Sun was already hypothesized in the 19th century to be at temperatures well exceeding those achievable on Earth in ordinary furnaces, it became inconceivable to think of the solar interior as anything but gaseous. Hence, the models advanced by Secchi, Faye, Stoney, Lane, and Young, could easily gain acceptance. However, modern science is beginning to demonstrate that hydrogen (which under ordinary conditions has a critical point at $\sim$33 K) can become pressure ionized such that its electrons enter metallic conductions bands, given sufficiently elevated pressures, as the band gap is reduced from 15 eV to $\sim$0.3 eV. Liquid metallic hydrogen will possess a new critical temperature well above that of ordinary hydrogen. Already, experiments suggests that it can exist at temperatures of thousands of Kelvin and millions of atmospheres (S. T. Weir et al., Phys. Rev. Let. 1996, 76, 1860). The formation of liquid metallic hydrogen brings with it a new candidate for the interior of the Sun and the stars. Its existence shatters the great pillar of the gaseous models of the Sun which the critical point of ordinary gases had erected.

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