to near-relativistic energies (~ 1 MeV) at a solar-system parallel shock. They examined 94 crossings of Saturn's bow-shock by the Cassini spacecraft and found only one case of electron acceleration when the configuration was quasi-parallel. This shock was exceptionally strong, with a Mach number (defined as the shock speed divided by the upstream wave-speed) of ~ 100 , the strongest of all those studied. This led Masters *et al.* to conclude that the occurrence of electron acceleration was associated with the unusual strength of the shock. The main evidence for shock acceleration is a rise and subsequent fall in the intensity of ~ 0.1 – 1 MeV electrons over a period of approximately one hour, with a peak intensity close to the time of shock crossing. A population of electrons leaking out into the solar wind with energies up to ~ 0.1 MeV, accelerated in the magnetosphere of Saturn, was also observed in the vicinity of the shock crossing. However, by comparing the

energy spectra of electrons observed well upstream of the shock, near it and downstream, the authors argue that a separate population of electrons is accelerated by the shock. The team noted that the magnetospheric electrons may have contributed to the source population for acceleration; but they infer that electrons from the solar wind made the main contribution.

These observations have important implications for modelling shock acceleration in astrophysical situations where the geometry is unknown. If electron acceleration is confined to quasi-perpendicular shocks, then assessment of the occurrence of electron acceleration requires careful modelling of the geometry. The observations of Masters *et al.* demonstrate, however, that electrons can be accelerated at quasi-parallel shocks (and presumably also at 'intermediate' arrangements), if strong enough. This indicates that electron acceleration is likely

to occur at strong astrophysical shocks, irrespective of the geometry, allowing electron acceleration at astrophysical objects to be modelled without detailed knowledge of the magnetic field and shock geometry. □

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ASTRONOMY

The wise hunter

For those with good eyesight gazing up at the constellation Orion, the middle star of his sword appears rather fuzzy. This is because it is not a single star but the Orion nebula, pictured, an active region of star formation — one of the closest to Earth, in fact, some 1,300 light-years away. NASA's space telescope, the Wide-field Infrared Survey Explorer (WISE), now shows us a truly panoramic view, 100 light-years across, of the nebula and its surrounding area. The brightest regions (blue and cyan) correspond to hot young stars whereas the cooler regions of interstellar dust appear green and red. Hot stars have burned through the dust to leave large cavities throughout the nebula, such as the one near the centre of the image.

The Orion nebula is part of the greater Orion Molecular Cloud Complex, along with the Horsehead and the Flame nebulae. All are actively forming stars. Fewer than 10 million years old, the young stars in the Orion nebula are densely packed. Astronomers believe that our Sun was formed in a similar cloud about 5 billion years ago. Newborn stars slowly drift apart, burning through dust to leave more isolated stars.

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