Astronomy & Astrophysics

HIGHLIGHTS: this week in A&A

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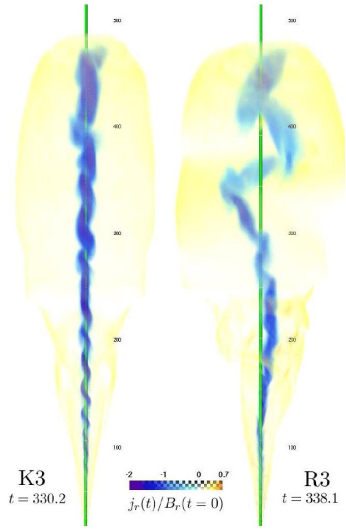
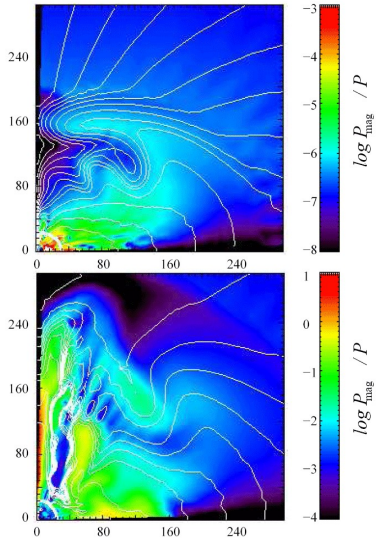
In section 2. Astrophysical processes

"Kink instabilities in jets from rotating magnetic fields", by R. Moll, H. C. Spruit, and M. Obergaulinger, A&A 492, p. 621

Using a spherical classical, ideal MHD code including the effects of heating and cooling, the authors study three-dimensional twisting and kink instabilities in expanding jets in density stratified media. The models show a rich spectrum of instabilities, especially the kink mode. The jets are launched from disks. The background shows the effects of the coupling, and also displays kinking. The acceleration is followed, along with the thermal properties of the jet. This will be an important study for those interested in nonrelativistic outflows, especially from protostellar sources.





In section 15. Numerical methods and codes

"A new general relativistic magnetohydrodynamics code for dynamical spacetimes", by P. Cerdá-Durán et al., A&A 492, p. 937

The paper describes a powerful new code for solving the equations of GRMHD for a fully dynamical, conformally-flat spacetime without restrictions on the magnetic field strength and including shock capture and a variety of realistic equations of state. The authors present extensive test cases (e.g., relativistic magnetic shocks, core collapse with the magneto-rotational instability, equilibrium configurations of magnetized neutron stars). Further developments will include neutrino transport modules and extensions of the microphysics.

In section 6. Interstellar and circumstellar matter

"Submillimeter water and ammonia absorption by the peculiar z=0.89 interstellar medium in the gravitational lens of the PKS 1830-211 system", by K. Menten et al., A&A 492, p. 725

Hydrides and, in particular, water are difficult to study with ground-based telescopes. It is one of nature's intriguing tricks, therefore these species can occasionally be observed at high redshift from the ground because strong transitions are shifted to wavelengths within atmospheric windows. This is the case for the observations reported by Menten et al. in this issue. They used the APEX telescope to detect water and ammonia in a galaxy at z=0.89 in absorption against the background emission of a gravitationally lensed quasar. Surprisingly perhaps, abundances seem to be similar to those found by space-borne telescopes in the Milky Way.

In section 13. Astronomical instrumentation

"Photon orbital angular momentum in astronomy", by N.M. Elias II, A&A 492, p. 883

Light carries more information than what is often believed. In the past decade, a new degree of freedom has been identified in the photon orbital angular momentum (POAM), which is associated to the spatial intensity distribution of an optical beam. POAM is a property of light beams housing phase defects called optical vortices. In such beams, the wavefront has a helicoidal shape, causing the Poynting vector to spin as a corkscrew around the direction of propagation. Photon orbital angular momentum (POAM) has thus become a topic of active research (see also A&A 488, 1159). The extensive article highlighted today explains POAM in an astronomical context and defines its observables for astronomy. It shows, in particular, how POAM propagates from celestial sphere to detector and relates POAM to existing astronomical instruments and concepts.