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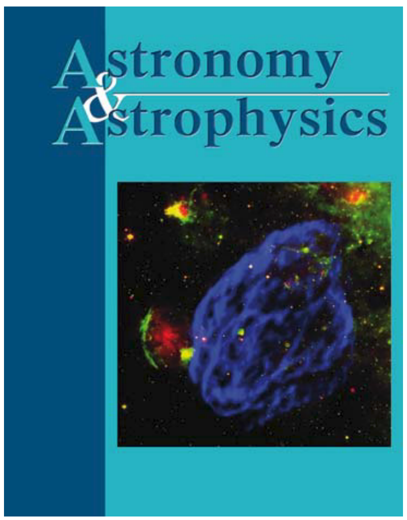

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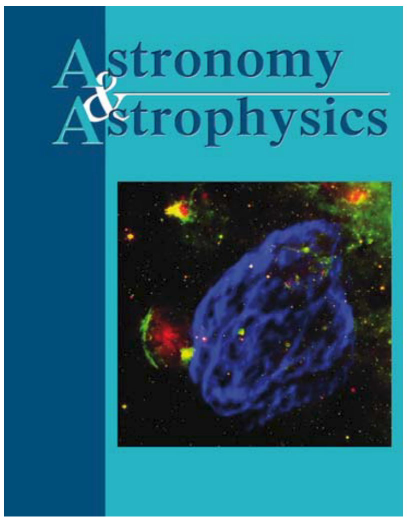

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Previous highlights

HIGHLIGHTS: this week in A&A

12 February 2010 (vol. 510)

In section 1. Letters

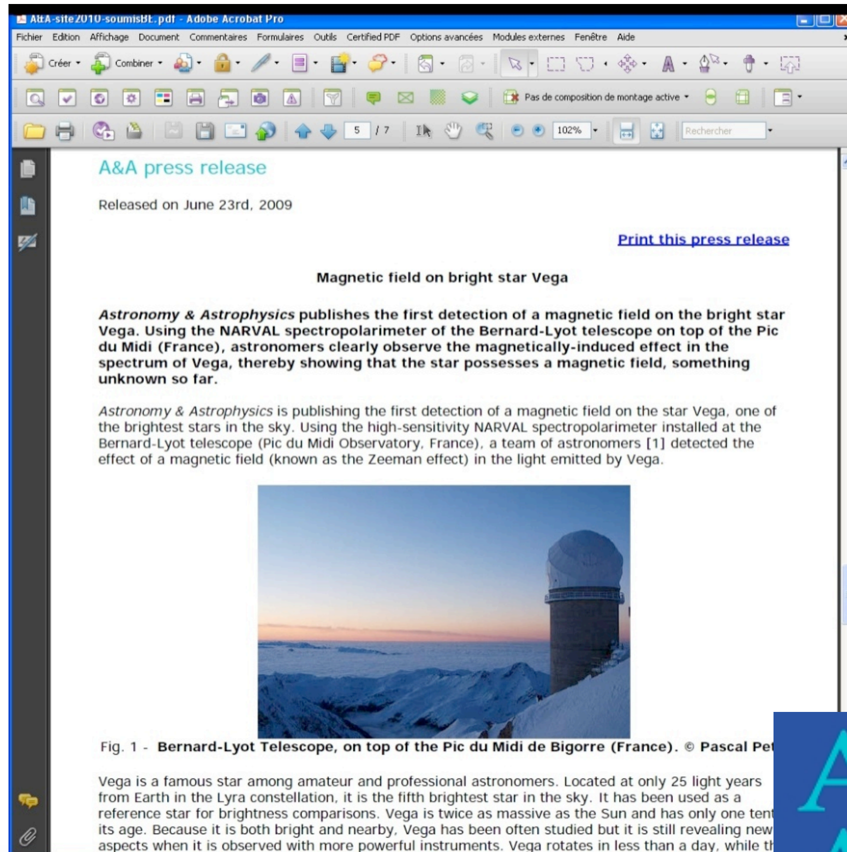
"Evidence for a thick disk rotation-metallicity correlation", by A. Spagna, M.G. Lattanzi, P. Re Fiorentin, and R.L. Smart, A&A 510, L4

Thick disks have been observed in both our Galaxy and many other disk galaxies. They represent the frozen relics of the first phases of disk galaxy formation. While many scenarii have been proposed for the formation of this component, its origin remains unclear. In this Letter, the authors present new results for the vertical rotation gradient and, for the first time, evidence of a metallicity-rotation correlation in the thick disk stellar population. These results provide strong constraints on the thick disk origin.

In section 6. Interstellar and circumstellar matter

"New 3D gas density maps of NaI and CaII interstellar absorption within 300 pc", by B.Y. Welsh, R. Lallement, J-L Vergely, and S. Raimond, A&A 510, A54

A&A Press release: Astronomy & Astrophysics is publishing new 3D maps of the interstellar gas in the local area around our Sun. A French-American team of astronomers presents new absorption measurements towards more than 1800 stars. They were able to characterize the properties of the interstellar gas within each sight line. Read the press release.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A&A press release

Released on June 23rd, 2009

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Magnetic field on bright star Vega

***Astronomy & Astrophysics* publishes the first detection of a magnetic field on the bright star Vega. Using the NARVAL spectropolarimeter of the Bernard-Lyot telescope on top of the Pic du Midi (France), astronomers clearly observe the magnetically-induced effect in the spectrum of Vega, thereby showing that the star possesses a magnetic field, something unknown so far.**

Astronomy & Astrophysics is publishing the first detection of a magnetic field on the star Vega, one of the brightest stars in the sky. Using the high-sensitivity NARVAL spectropolarimeter installed at the Bernard-Lyot telescope (Pic du Midi Observatory, France), a team of astronomers [1] detected the effect of a magnetic field (known as the Zeeman effect) in the light emitted by Vega.

Fig. 1 - **Bernard-Lyot Telescope, on top of the Pic du Midi de Bigorre (France). © Pascal Pet**

Vega is a famous star among amateur and professional astronomers. Located at only 25 light years from Earth in the Lyra constellation, it is the fifth brightest star in the sky. It has been used as a reference star for brightness comparisons. Vega is twice as massive as the Sun and has only one tent its age. Because it is both bright and nearby, Vega has been often studied but it is still revealing new aspects when it is observed with more powerful instruments. Vega rotates in less than a day, while th

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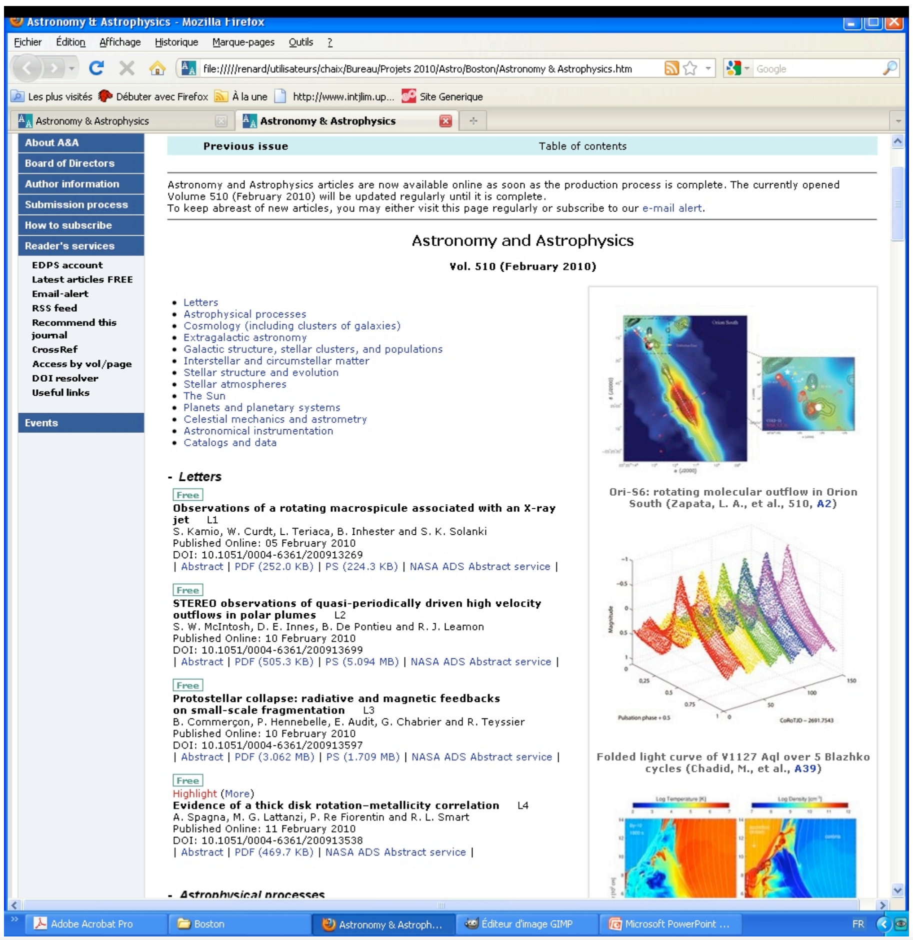

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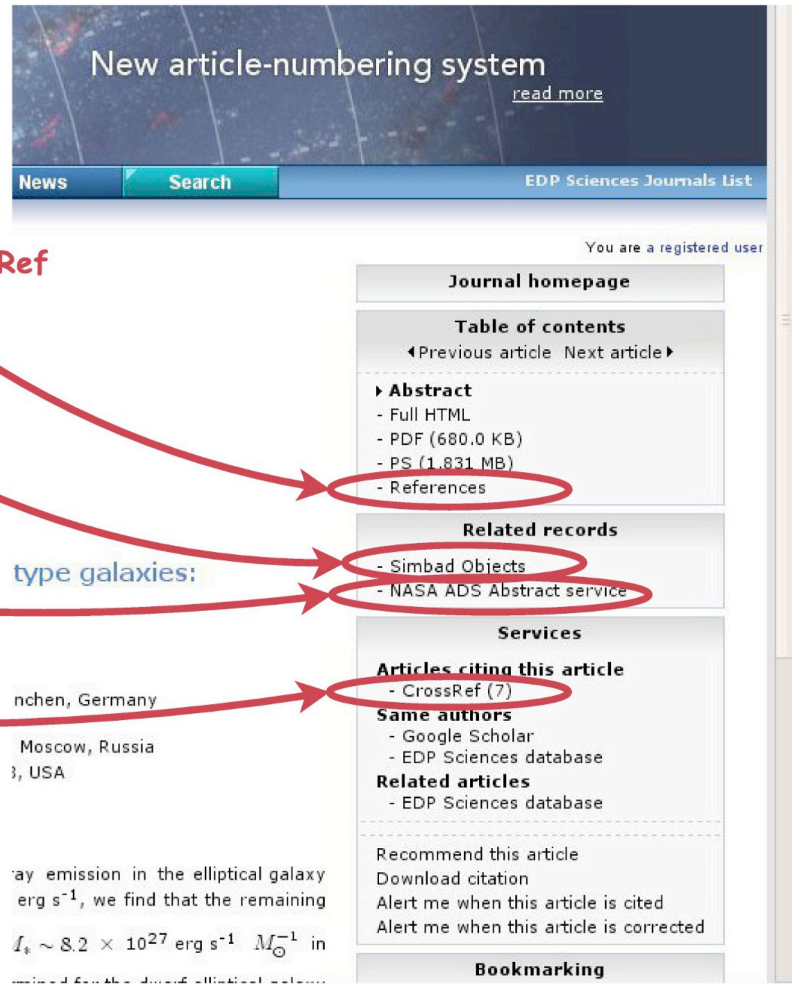

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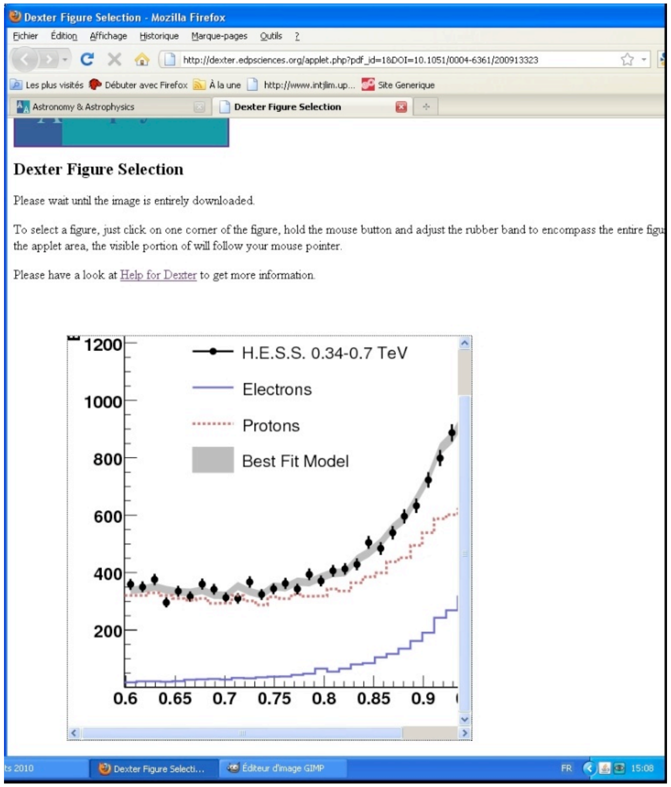

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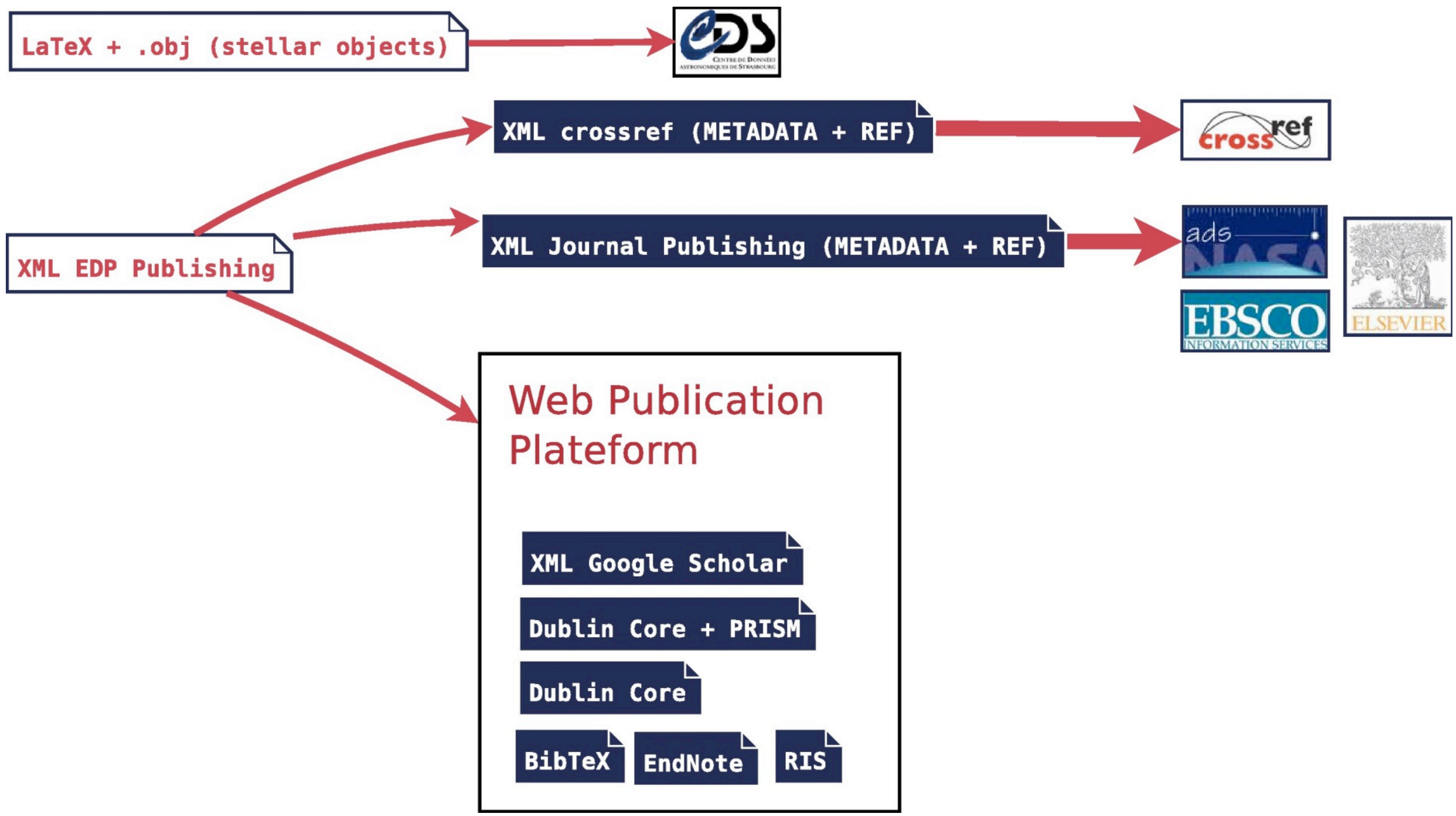

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Jutzi, M., Michel, P., & Benz, W. 2010, A&A, 509, L2

Janiuk, A., & Yuan, Y-F., 2010, A&A, 509, A55

Astronomy and Astrophysics: electronic first

A&A 509, A55 (2010)
DOI: 10.1051/0004-6361/200912725

Astronomy & Astrophysics

The role of black hole spin and magnetic field threading the unstable neutrino disk in gamma ray bursts

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tori have been already discussed in a number of works (e.g. Popham et al. 1999; Di Matteo et al. 2002; Kohri et al. 2005; Chen & Beloborodov 2007; Janiuk et al. 2004, 2007; Lei et al. 2009).

In the present paper we expand on our previous work, and we further investigate the properties and evolution of such hot and dense accretion tori. At the extreme densities and temperatures, determined by the hyper-Eddington accretion rate, the torus is cooled mainly by neutrino emission produced primarily by electron and positron capture on nucleons (β reactions). The model we develop here was first described in Janiuk et al. (2004) for

plausible mechanism that helps to launch the jets emitted in a narrow cone along the rotation axis. As shown in Janiuk et al. (2008), especially for the long duration GRBs the BH spin is required to sustain the central engine activity and the jet production for a sufficiently long time. Because these long GRBs often exhibit a very variable temporal structure (e.g. Beloborodov et al. 2000), it seems very important to study a possible instability mechanism that may account for the variability. We check here for which values of the black hole spin the instability may operate near the central black hole, depending on the accretion rate and viscosity in the disk. We also check what effects may be

imposed on the torus and its unstable strip by the additional heating via the magnetic fields, threaded by the rotating black hole. The content of the article is as follows. First, we discuss the basic assumptions and present the main equations of the model. Second, we introduce the changes and corrections to the model that are the result of a black hole rotation with an arbitrary spin. Third, we introduce the energy extraction from the rotating black hole via the magnetic field, as an additional physical process that may operate in the gamma ray burst central engine. In Sect. 3 we present the results of our calculations, and in Sect. 4 we discuss the results and conclude.

2. Model

The model of a neutrino-cooled accreting torus was fully discussed in Janiuk et al. (2004, 2007). Here we briefly repeat the basic assumptions, and the model equations are given in

and from protons to neutrons for a given baryon number density, n_b, and temperature, T. These reactions are electron and positron capture on nucleons and neutron decay (see Kohri et al. 2005; Janiuk et al. 2007). The closing equations for the EOS are the conservation of the baryon number, $n_n + n_p = n_b X_{nuc}$, and the charge neutrality (Yuan 2005).

For the neutrino cooling of the torus, we consider the electron-positron pair annihilation, bremsstrahlung, plasmon decay and beta reactions. Each of these emission processes has a reverse one, which leads to neutrino absorption, and we calculate the absorptive optical depth τ_{a,ν_i} for the neutrinos of the three flavors. In addition, the free escape of neutrinos from the disc is limited by scattering, and we calculate the scattering optical depth τ_s. The neutrino cooling rate is therefore in the neutrino-thick torus given by

$$Q_\nu^- = \frac{\frac{7}{8}\sigma T^4}{\frac{3}{4}} \sum \frac{1}{[illegible]} \qquad (3)$$

positron pairs, and the neutrino pressure is calculated for the trapped neutrinos, using the two-stream approximation (Popham & Narayan 1995; Di Matteo et al. 2002). We consider both the neutrino transparent and opaque regions as well as the transition between the two, and in order to determine the distribution function of the partially trapped neutrinos we use a "gray body" model (Sawyer 2003), consistent with the two-stream approximation.

The chemical potentials, or equivalently the ratio of free protons, $x = n_p/n_b$, are determined from the condition of equilibrium between the transition reactions from neutrons to protons

The total flux of energy generated at the radius r is determined by the global model parameters, i.e. the black hole mass and accretion rate:

$$F_{tot} = \frac{3GM\dot{M}}{8\pi r^3} f(r) \qquad (9)$$

where $f(r)$ stands for the inner boundary condition and will be given below. In order to calculate the initial stationary configuration, we solve the energy balance:

$$F_{tot} = Q^+_{visc} = Q^-_{adv} + Q^-_{rad} + Q^-_\nu + Q_{photo}. \qquad (10)$$

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