## Early X-ray emission from novae: the case of the symbiotic recurrent nova RS Oph

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## Abstract

Novae can be sources of high-energy photons, reaching GeV energies. Such emission is a consequence of  $\pi^0$  decay and/or Inverse Compton, which are related to particle (p and e<sup>-</sup>) acceleration. The strong shock between matter ejected by white dwarf (WD) and the circumstellar medium is responsible for this process. The 2006 outburst of RS Oph was the first nova for which particle acceleration was predicted. Our aim is to understand the acceleration process through the analysis of contemporaneous X-ray emission. We present an analysis of the XMM-Newton's observations of RS Oph early after its 2006 outburst both with RGS and EPIC-MOS, which have a broader energy range than RGS. We will compare with RXTE, Swift/BAT and Chandra observations, to get a global picture of VHE y -ray emission in novae and its relationship with particle acceleration.

## **RS Oph**

A nova is a thermonuclear explosion on the surface of a WD star, in a close binary system. The WD accretes hydrogen-rich matter from a stellar companion. Novae do not destroy completely the WD and for this reason the outburst is expected to recur. There are two scenarios: cataclysmic variable and symbiotic system. RS Oph is a recurrent nova in a symbiotic system composed of a WD and a RG with a recurrence period of ~ 21 years. The latest outburst occurred on 2006 February 12.83. Mwb should be large to explain recurrent explosions. Therefore this type of novae is a possible scenario for a SNIa.

MM-Newton Observations

ICE

- RXTE /PCA (Energy range: 3-20 keV). Sokoloski et al.[1]. Socked plasma at T>10<sup>7</sup>K. (see Fig. 1).
- Swift /BAT (Energy range: 14-50 keV) and XRT (Energy range: 0.3-10 keV). Bode et al. [2]. Temporal evolution of NH and vshock. Tattischeff & Hernanz [3] showed that the blast wave decelerated faster than expected as a consequence of acceleration of particles in the shock.
- Fermi/LAT (Energy range: 30 MeV- 300 GeV). In 2010 detected the V407 Cyg (Abdo et al. [4]). It has detected six novae so far, two recurrent novae and four classical novae

## Observations

We extracted spectra from XMM-Newton/ EPIC MOS1 (Energy range: 0.3-10 keV) and RGS (5-25 Å)in days 13.8 (ID 0410180101) & 26.1 (ID 0410180201) after outburst. We have used SAS for data reduction. We have corrected the MOS data for pile up and have checked that there is not pile-up in RGS.



Plasma temperature obtained from the line widths (RGS) are compatible with plasma temperatures fitting MOS data. Fast temporal evolution of plasma temperatures is obtained, in general, agreement with RXTE and Swift data.