The first low-mass, pre-main sequence eclipsing binary with evidence of a circumbinary disk

Ed Gillen*[1], Suzanne Aigrain[1], Amy Mcquillan[2], Jerome Bouvier[3], Simon Hodgkin[4], Silvia Alencar[5], Caroline Terquem[1], John Southworth[6], Neale Gibson[7], Ann Marie Cody[8], Monika Lendl[9], Maria Morales-Calderon[10], Fabio Favata[11], John Stauffer[8], and Giusi Micela[12]

[1]University of Oxford – United Kingdom
[2]Tel Aviv University – Israel
[3]Institut de Planétologie et d'Astrophysique de Grenoble – Institut de Planétologie et d'Astrophysique de Grenoble, Institut de Planetologie et d'Astrophysique de Grenoble – France
[4]Institute of Astronomy, University of Cambridge – United Kingdom
[5]Universidade Federal de Minas Gerais (UFMG) – Av. Antônio Carlos, 6627 - Pampulha - Belo Horizonte - MG, Brazil
[6]Keele University – United Kingdom
[7]European Southern Observatory (ESO) – Karl-Schwarzchild Str. 2 D-85748 Garching bei Munchen, Germany
[8]Spitzer Science Center, California Institute of Technology – United States
[9]Observatoire de Geneve, Universite de Geneve – Switzerland
[10]Centro de Astrobiologia (INTA-CSIC) – Spain
[11]European Space Agency – European Space Agency – France
[12]INAF - Osservatorio Astronomico di Palermo – Italy

Abstract

We present a new double-lined, detached eclipsing binary, which comprises two pre-main sequence M dwarfs and shows evidence of a circumbinary disk. This unique system, which could be a precursor of the circumbinary planetary systems discovered by Kepler, enables us to test evolutionary models of low mass stars, and the interaction between a close binary and a circumbinary disk.
CoRoT223992193 was discovered by the CoRoT space mission during a continuous, 23-day observation of the NGC2264 star-forming region. Using our innovative Gaussian process regression methods, we solve the orbit and derive the fundamental parameters of both stars by modelling the CoRoT photometry together with WHT/ISIS and VLT/FLAMES spectra.

The system's spectral energy distribution (SED) shows a mid-infrared excess that can be modelled as thermal emission from dust in the inner cavity of a circumbinary disk. Additionally, the CoRoT light curve contains large-amplitude, rapidly evolving out-of-eclipse variations, which might be due in part to occultations of the central stars by material located at the inner edge or in the central cavity of the circumbinary disk. We are now analysing the out-of-eclipse variability using a second season of coordinated CoRoT, Spitzer

*Speaker

and CFHT/MegaCam observations.
I will present the stellar fundamental parameters and our SED modelling, before discussing our ongoing work on the origin of the out-of-eclipse variations and variations in the system's multi-component H alpha line profile.