

# Cláudia Vilega Rodrigues

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**Abрил/2019**

**Workshop da DAS**

# Supervisões

## \* *Diogo Belloni*

- pós-doc Fapesp
- hoje BEPE em Valparaíso - M. Schreiber

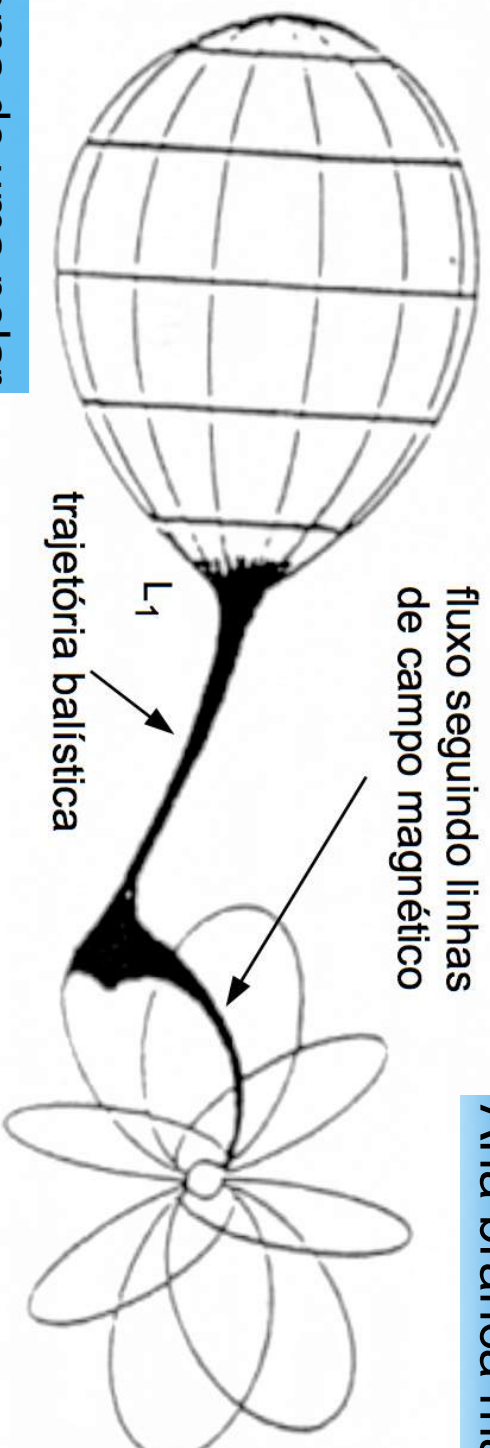
## \* *Isabel de Jesus Lima*

- doutorado Fapesp
- hoje BEPE na Univ. Washington - P. Szkody

# **Variações catodólmicas, com ênfase nas magnéticas**

# Polares (e IPs)

Sequência principal  
baixa massa



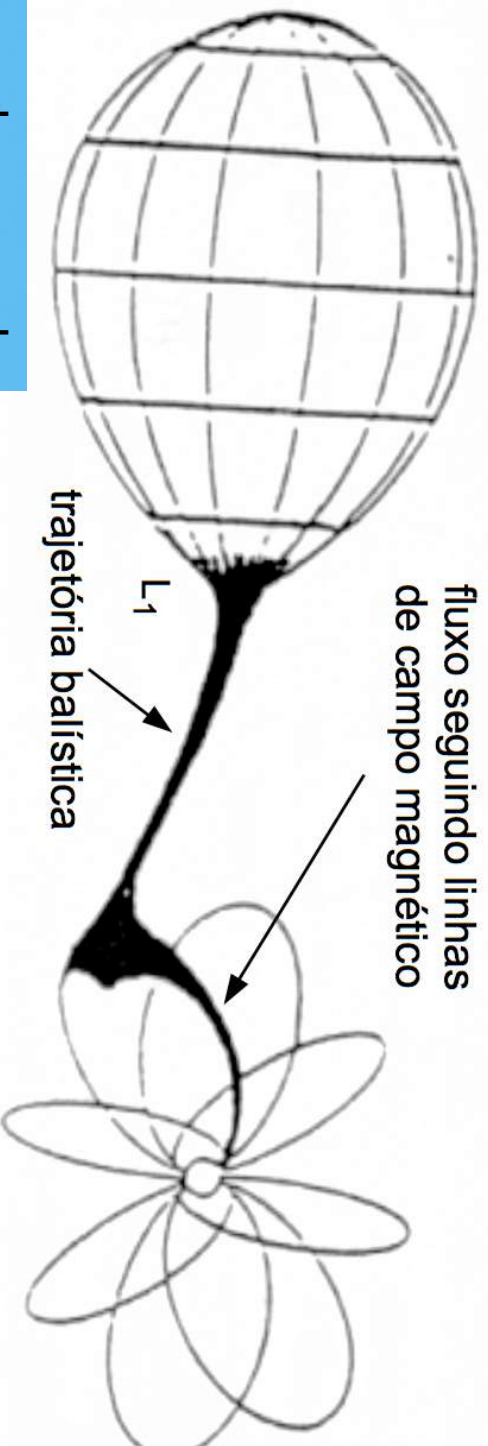
Anã branca magnética

Esquema de uma polar

Gropper (1990)

# Polares (e IPs)

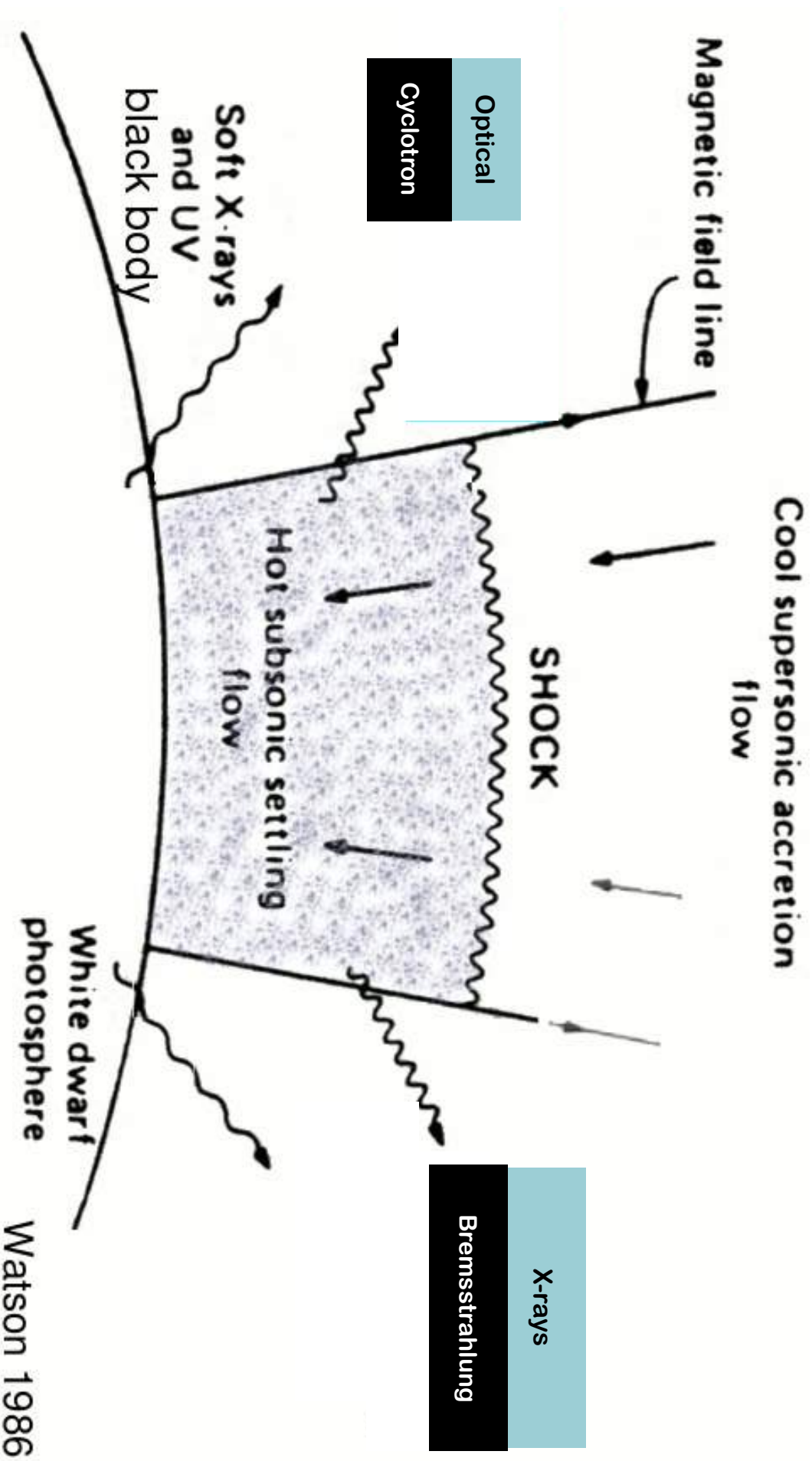
- Observações: fotometria, polarimetria e espectroscopia
- Modelos ópticos e raios X



Esquema de uma polar

Gropper (1990)

# Região emissora



Watson 1986



**Cycllops**  
Cyclotron Emission of Polars

## **\* Modelo de emissão da região pós-choque**

- transporte radiativo
- região 3D
- principais parâmetros:
  - densidade
  - temperatura
  - campo magnético

# Cyclops - 2018

## **\* Implementação da solução do choque**

- *provê as funções que descrevem como densidade e temperatura variam na região emissora*
- *Diogo Belloni*



# Cyclops - 2018

## \* Implementação da solução do choque

- provê as funções que descrevem como densidade e temperatura variam na região emissora

- Diogo Belloni

The white dwarf mass distribution of polars and intermediate polars from archival XMM-Newton data. I. post-shock region modelling and first results on AM Her, LSQ1725-64, EX Hya and AE Aqr

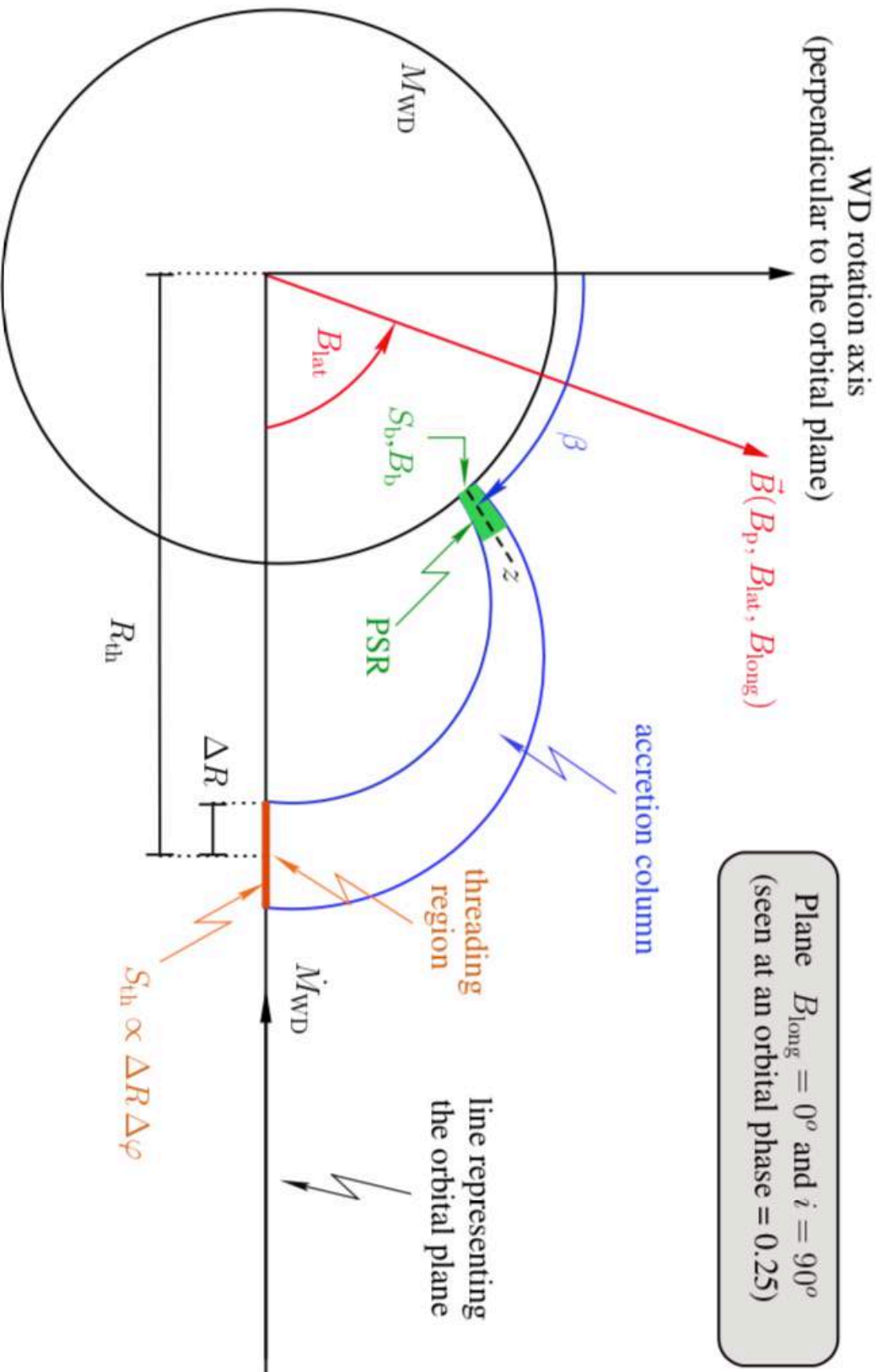
DIOGO BELLONI,<sup>1,2</sup> CLÁUDIA V. RODRIGUES,<sup>1</sup> TERESA J. STUCHI,<sup>3</sup> PAULO E. STECCHINI,<sup>1</sup> MANUEL CASTRO,<sup>1</sup> KARLEÝNE M. G. SILVA,<sup>4</sup> AND ISABEL J. LIMA<sup>1</sup>

<sup>1</sup>National Institute for Space Research, Av. dos Astronautas, 1758, 12227-010, São José dos Campos, SP, Brazil

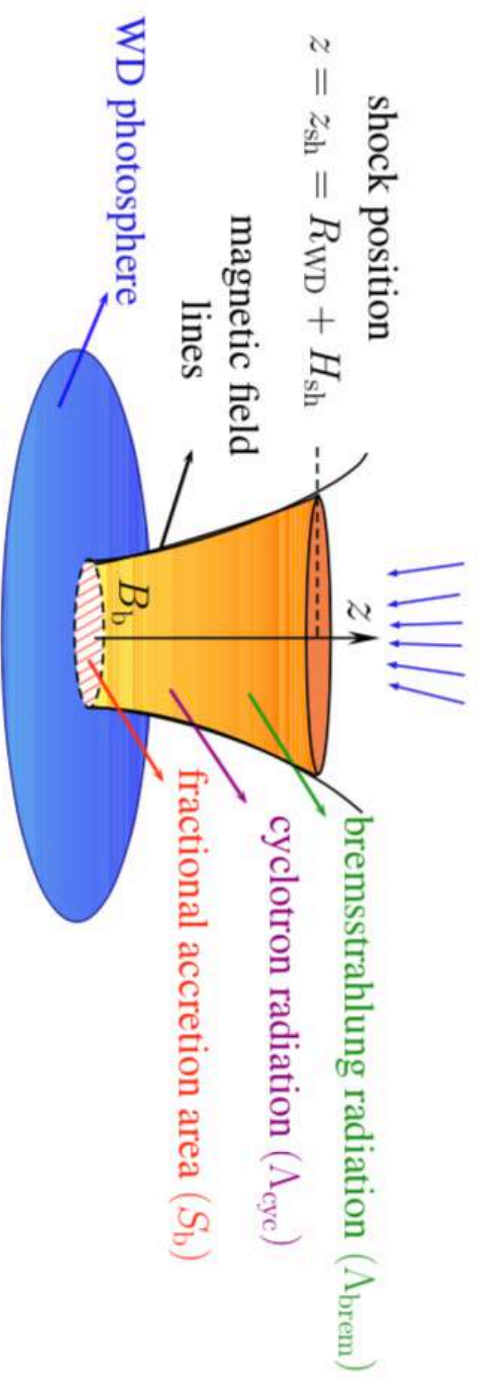
<sup>2</sup>Institute of Physics and Astrophysics, Valparaíso University, Av. Gran Bretaña 1111, Valparaíso, Chile

<sup>3</sup>Department of Mathematical Physics, UFRJ, P.O. Box 68528 21945-970, Rio de Janeiro, RJ, Brazil

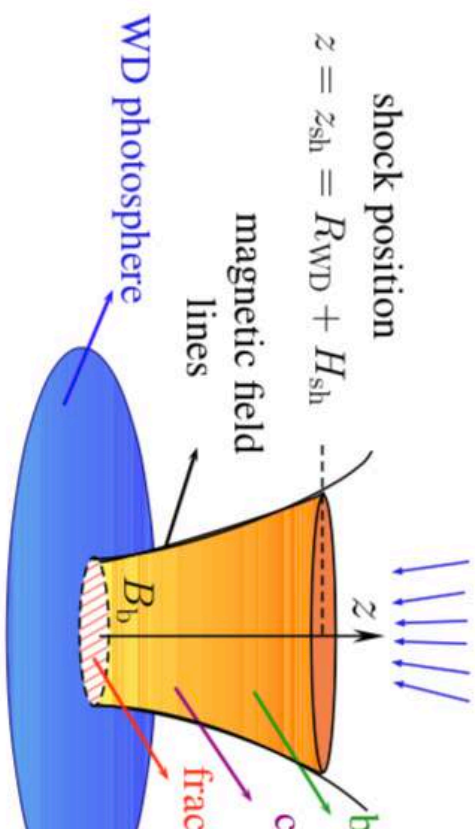
<sup>4</sup>European Southern Observatory, Alonso de Cordova 3107, Vitacura, Casilla 19001, Santiago, Chile



supersonic flow



## supersonic flow



of  $z$  only (see Fig. 2) within the PSR. Under such assumptions, the differential equations related to the mass continuity, and the momentum conservation and energy conservation are (e.g. Hayashi & Ishida 2014a):

$$\frac{d}{dz}(S\rho v) = 0, \quad (2)$$

$$\frac{d}{dz}(\rho v^2 + P) + \frac{\rho v^2}{S} \frac{dS}{dz} + \rho g_{\text{WD}} = 0, \quad (3)$$

$$v \frac{dP}{dz} + \gamma P \frac{dv}{dz} + (\gamma - 1) \left( \Lambda - \frac{\rho v^3}{2S} \frac{dS}{dz} \right) = 0, \quad (4)$$

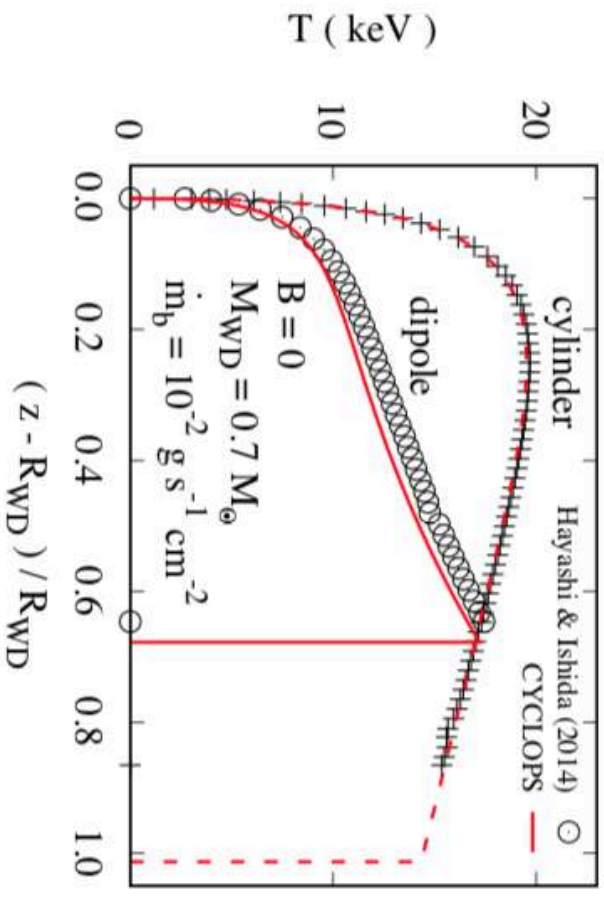
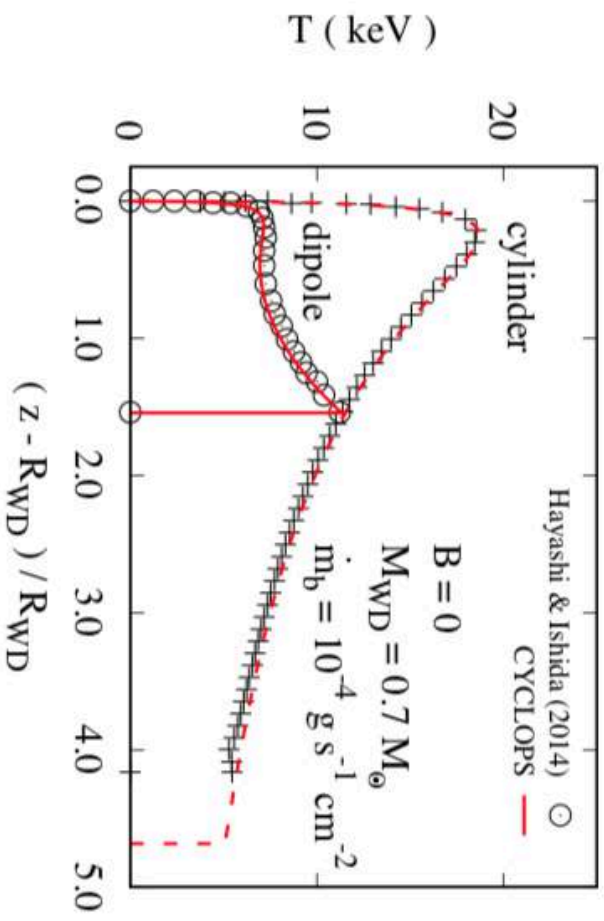
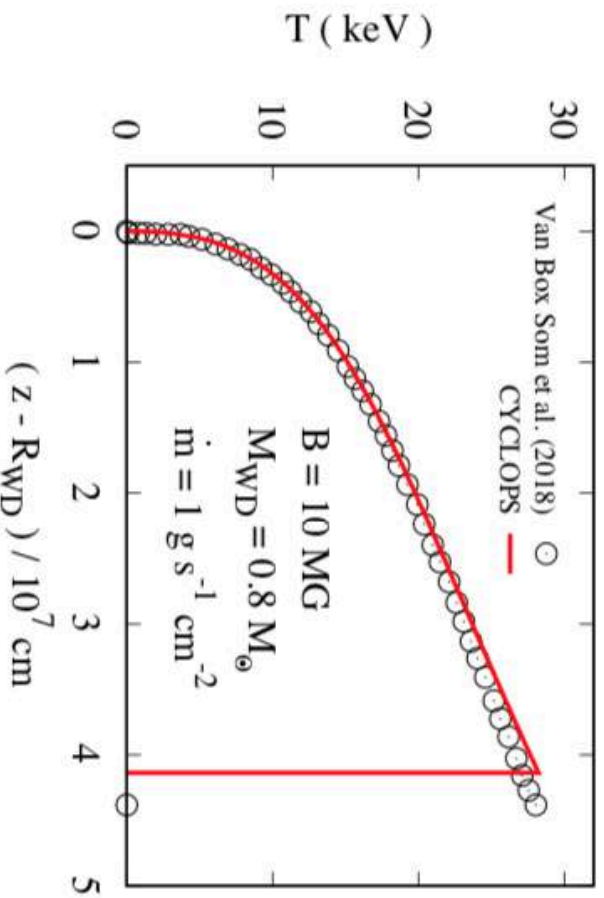
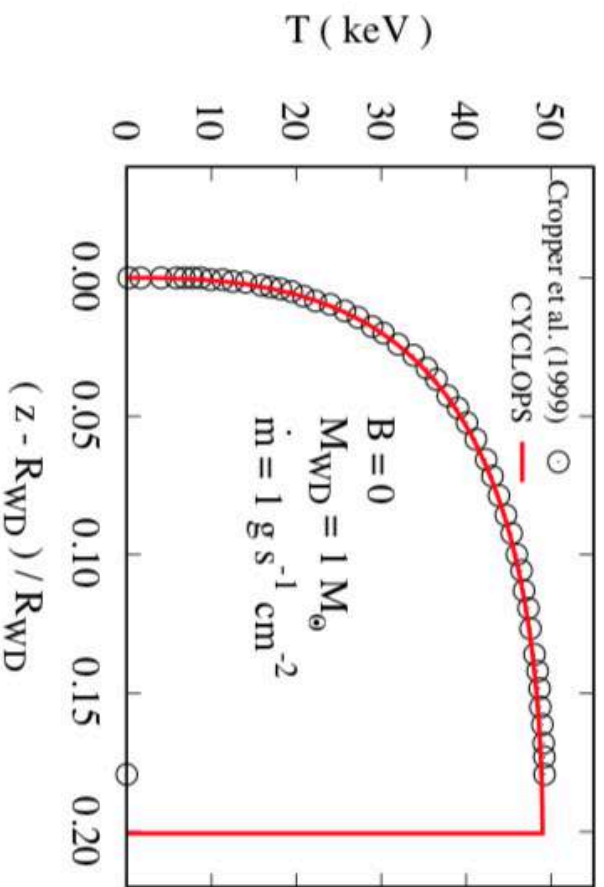
where  $v(z)$  is the flow velocity,  $S(z)$  is the cross-section,  $\Lambda(z)$  is the cooling function, which is described in Section 3.4, and  $g_{\text{WD}}(z)$  is the WD gravitational field, given by

$$g_{\text{WD}}(z) = \frac{GM_{\text{WD}}}{z^2}, \quad (5)$$

where  $G = 6.67259 \times 10^{-8} \text{ cm}^3 \text{ g}^{-1} \text{ s}^{-2}$  is the gravitational constant and  $M_{\text{WD}}$  is the WD mass.

Note that Equation 2 has an integral of the form

$$S(z)\rho(z)v(z) = S(z)m(z) = \dot{M}_{\text{WD}} \quad (6)$$





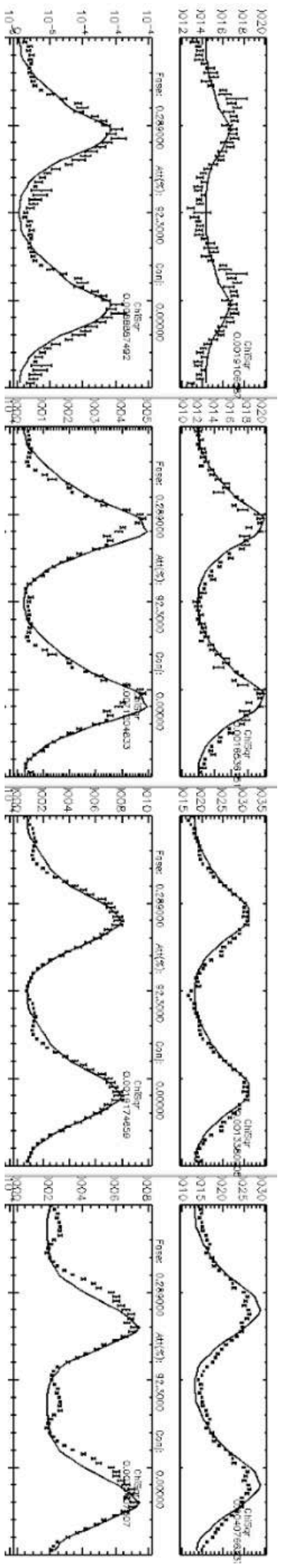
# V348 Pav

B band

R band

V band

I band



Upper: Total flux

Bottom: Circularly polarized flux

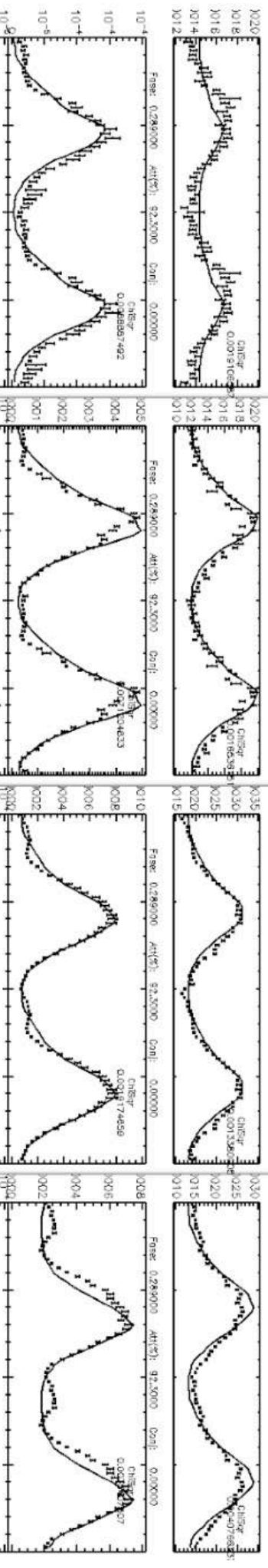
# V348 Pav

B band

R band

V band

I band

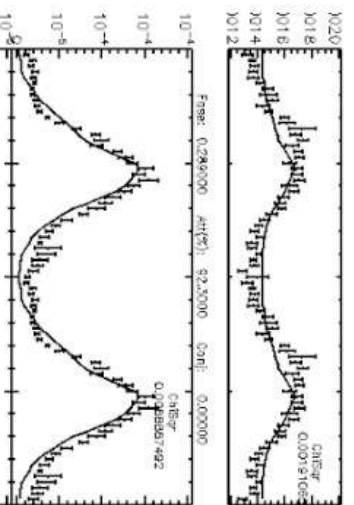


Modelled image of the region

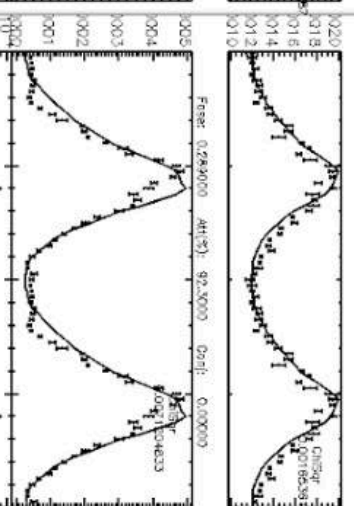
as function of the white-dwarf rotation phase

# V348 Pav

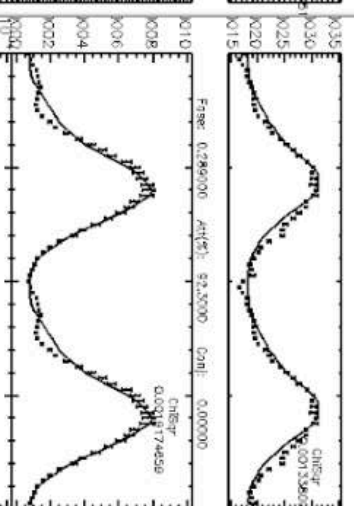
B band



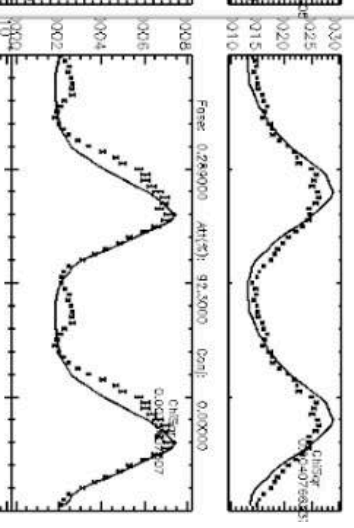
R band



V band



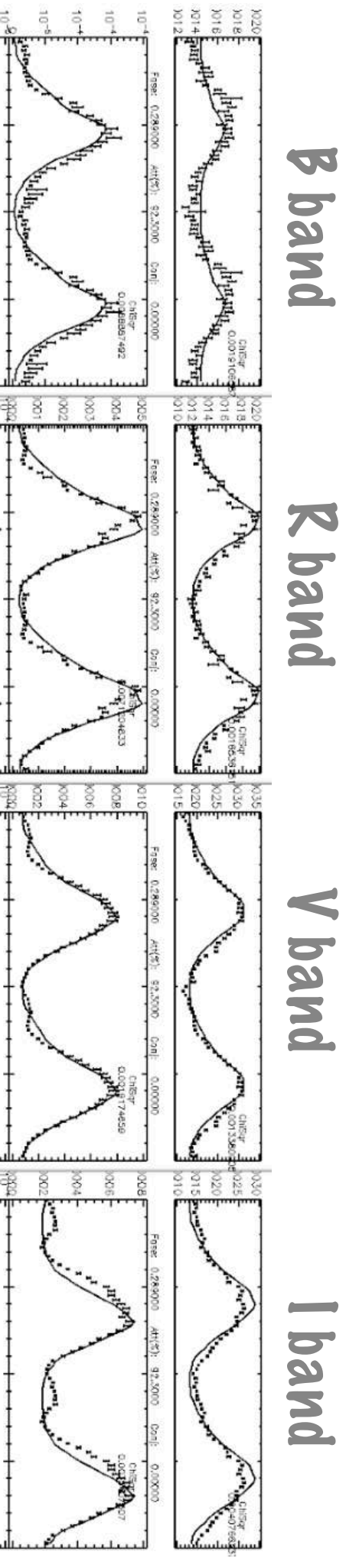
I band




$M_{\text{wd}} > 1.0 M_{\text{Sun}}$



# V348 Pav



## Magnetic accretion modelling using CYCLOPS: V348 Pav, a polar with a high-mass white dwarf

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<sup>1</sup> IP&D, Universidade do Vale do Paraíba, Av. Sítio Juvina Hifume, 2911, 12244-000, São José dos Campos/SP, Brazil

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<sup>4</sup> European Southern Observatory, Alonso de Córdoba 3107, Viacura, Santiago, Chile

# 4U 0142+61

## **\* Anomalous X-ray Pulsar (AXP)**

- **com emissão óptica modulada com o mesmo período de X-rays**
- **com emissão infravermelha**

## **\* Poderia ser uma anã branca?**

AN WHITE DWARF ACCRETION MODEL FOR THE ANOMALOUS X-RAY PULSAR 4U 0142+61

SARAH V. BORGES<sup>1</sup>, CLAUDIA. V. RODRIGUES<sup>2</sup>, JAZIEL G. COELHO<sup>3</sup>, MANUEL MALHEIRO<sup>1</sup>

*Draft version April 9, 2019*

+ Manuel Castro

Mestrado no ITA

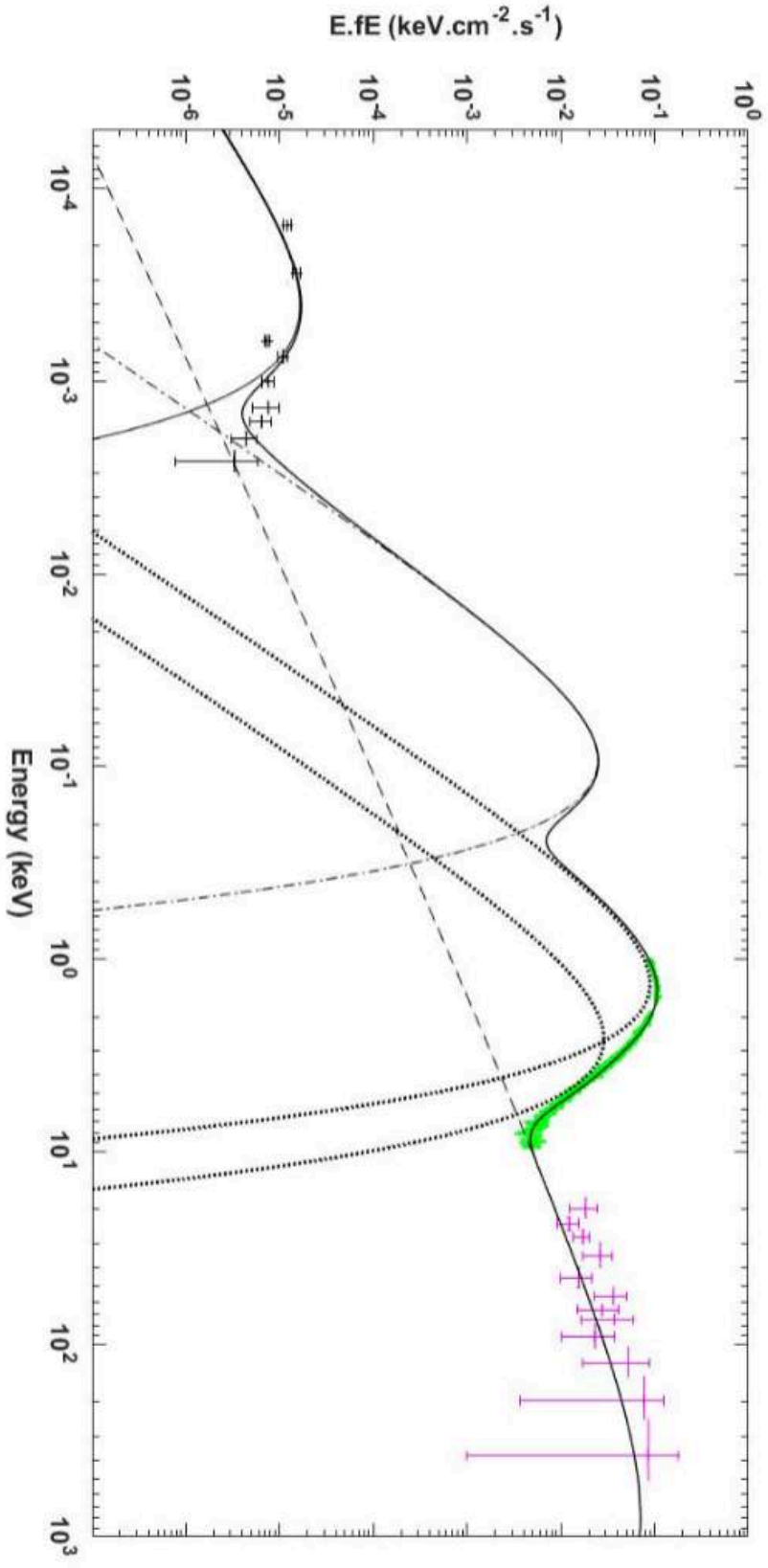


FIG. 2. — Derreddened and deabsorbed SED of 4U 10142+61 along with the best fit. The black crosses are from Wang et al. (2006, mid-infrared), Durant & van Kerkwijk (2006c, near-infrared) and Muñoz-Darias et al. (2016, optical); green crosses are soft X-rays from Enojo et al. (2010, Suzaku); and magenta crosses are the 2003.12 data from Wang et al. (2014, INTEGRAL). The bold black curve is the complete fit; the filled curve is the disk component; the dot-dashed curve is the WD photosphere; the dotted curves are each one of the hot spots components; and the dashed curve is the bremsstrahlung component.

AN WHITE DWARF ACCRETION MODEL FOR THE ANOMALOUS X-RAY PULSAR 4U 0142+61

SARAH V. BORGES<sup>1</sup>, CLAUDIA. V. RODRIGUES<sup>2</sup>, JAZIEL G. COELHO<sup>3</sup>, MANUEL MALHEIRO<sup>1</sup>

*Draft version April 9, 2019*

+ **Manuel Castro**

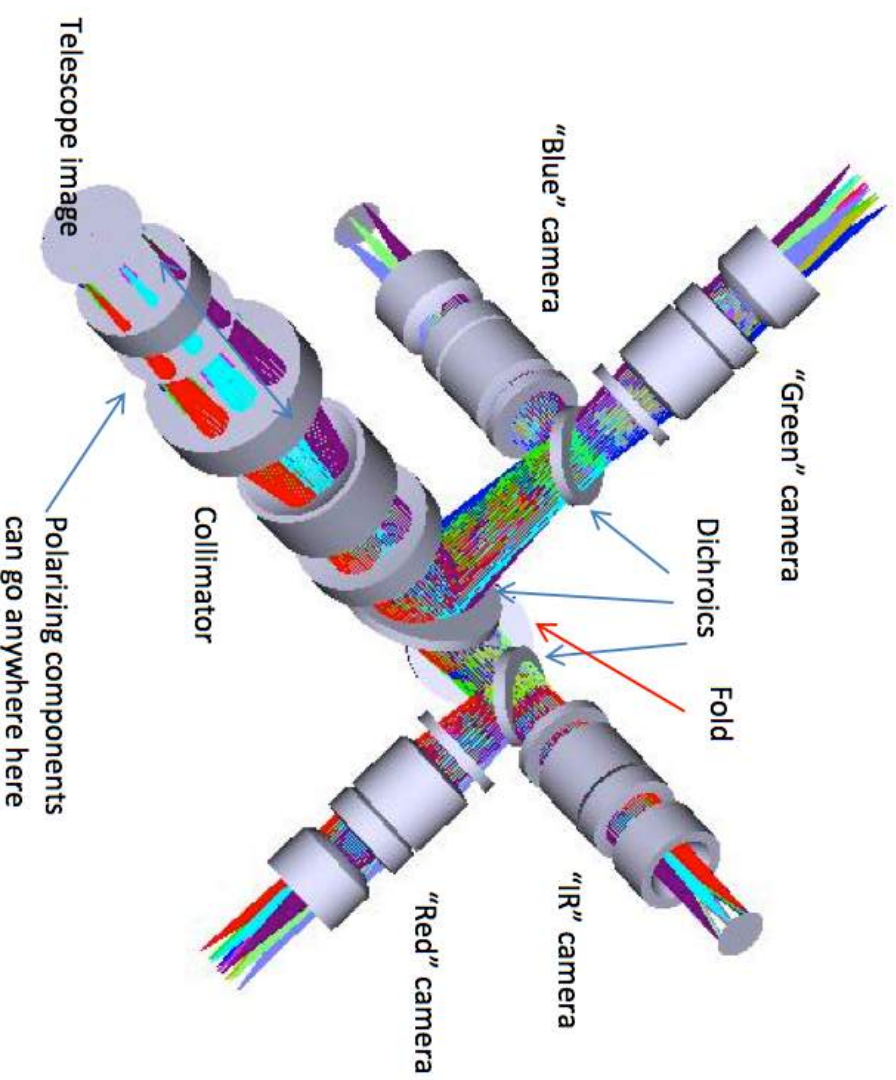
**Modelo é consistente com uma anã branca muito quente e com massa próxima ao limite de Chandrasekhar.**

**Possível origem em um merger de anãs brancas.**

**Disco seria resquício dessa fusão.**

# Instrumentação Astronômica

# SPARCG4



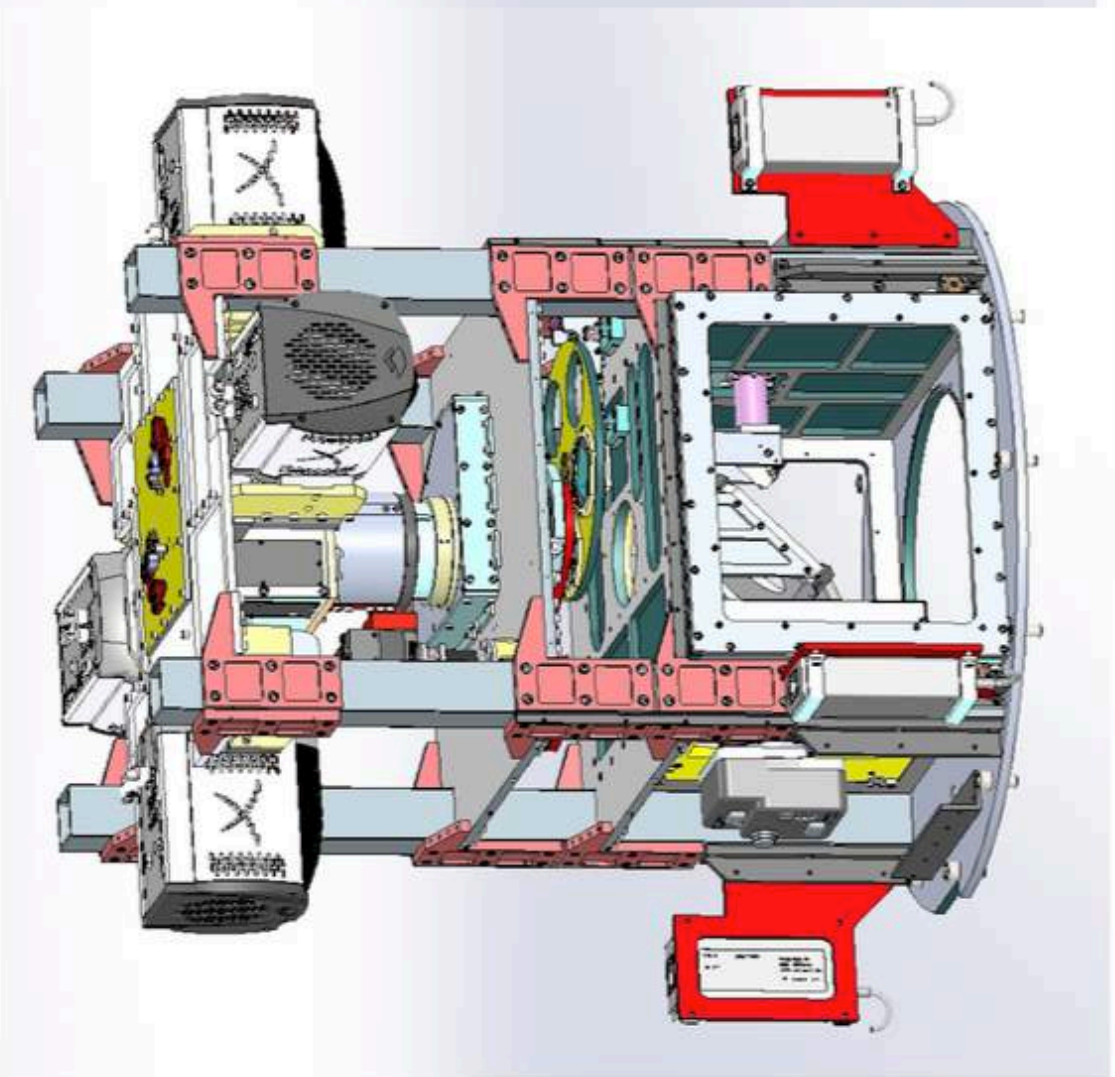
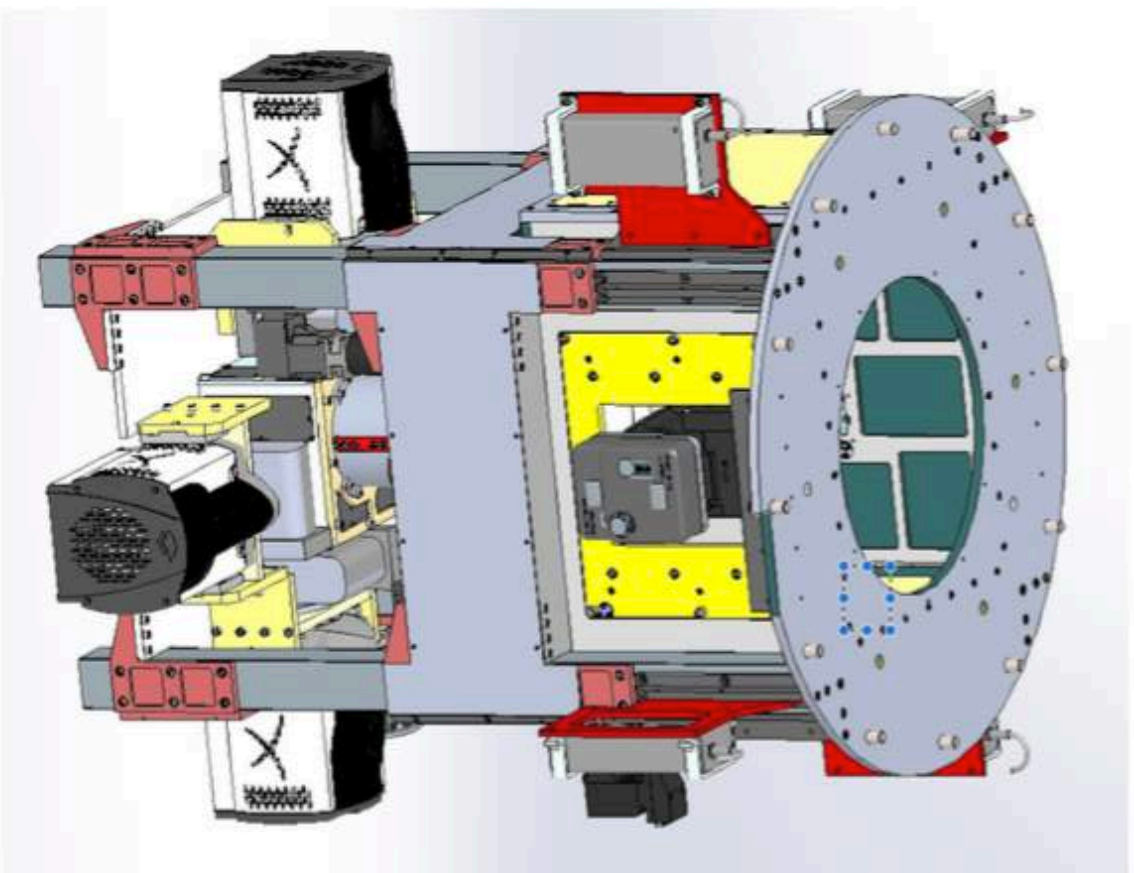
**\* Projeto de instrumento para telescópio 1,6 m do OPD**

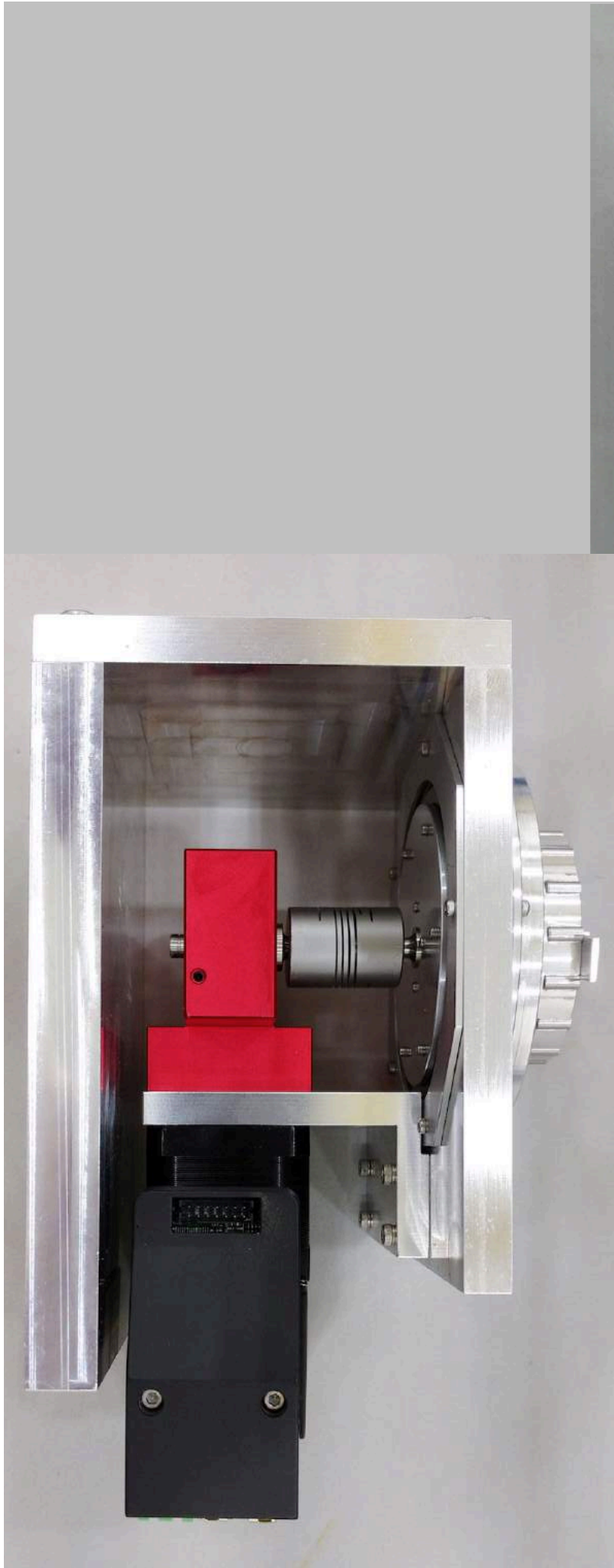
**\* Câmera 4 bandas simultâneas (griz)**

- polarimetria
- resolução temporal da ordem/melhor que 1s

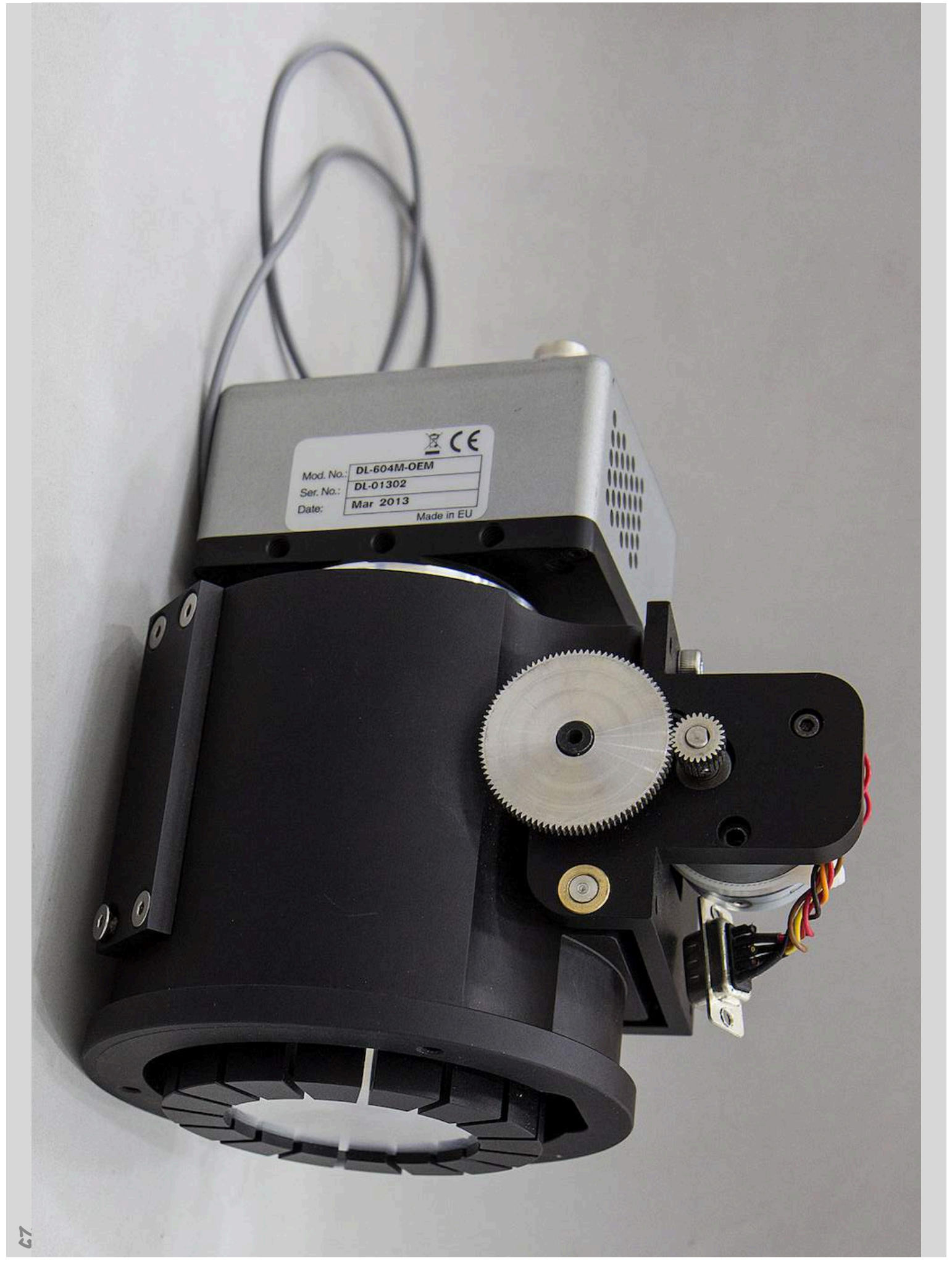


# Visão geral









Mod. No.: DL-604M-OEM  
Ser. No.: DL-01302  
Date: Mar 2013  
Made in EU

**Obriqada!**