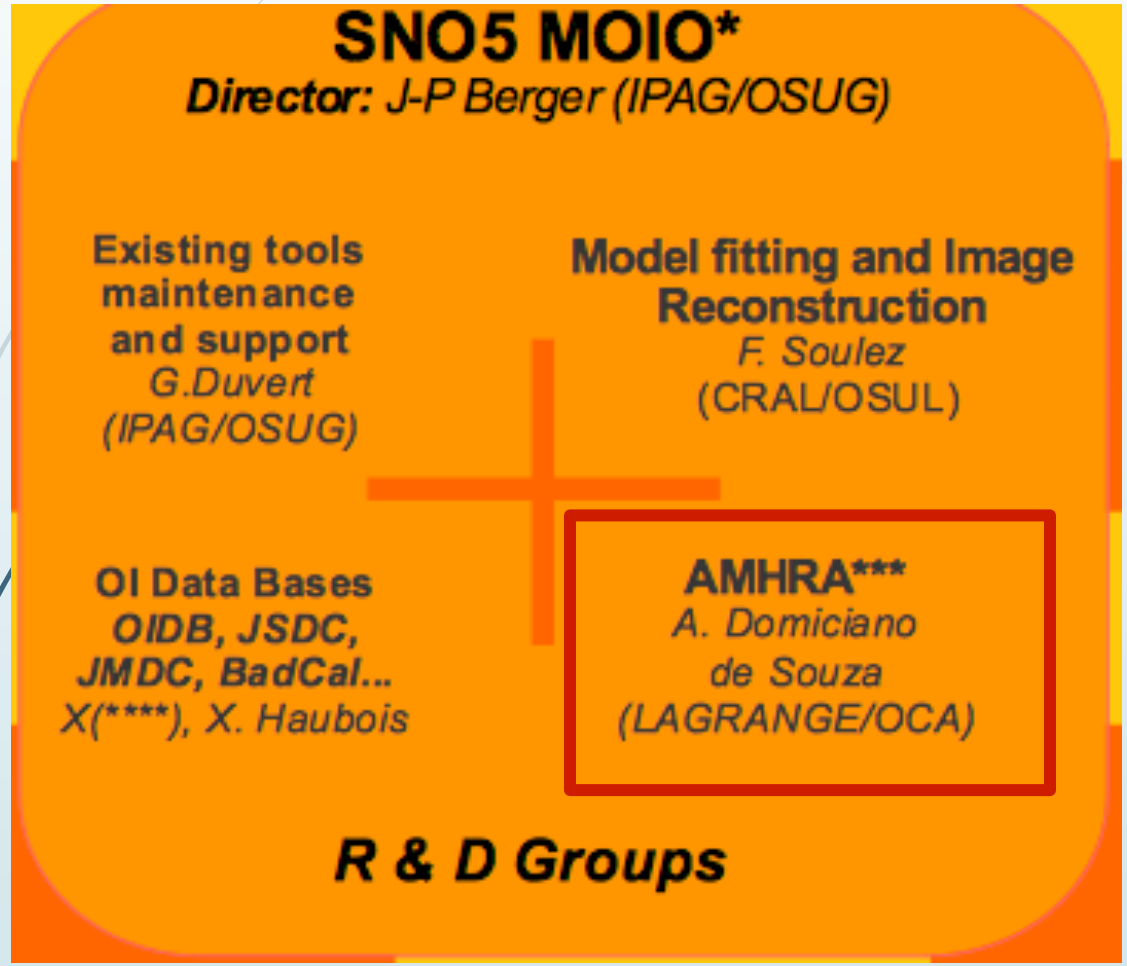
AMHRA MOIO/JMMC
(ANALYSE ET MODÉLISATION EN HRA)

HTTPS://AMHRA.OCA.EU/AMHRA/INDEX.HTM

Resp.: **Armando DOMICIANO DE SOUZA** (OCA-Lagrange)

Membres/contributeurs (liste non exhaustive): **A.Meilland, F.Millour, A.Soulain, A.Chiavassa, A.Matter, M.Benisty, G.Verbiese, J.-P.Ghibaudo** (OCA-Lagrange) **L.Bourgès, G.Mella, J.-P. Berger** (OSUG), **A.C.Carciofi, D.Moser** (IAG-Brésil), **E.S.G. de Almeida** (Chili), et al.

AMHRA dans MOIO



- Valorisation des données spectro-interférométriques (VLTI MATISSE & GRAVITY, CHARA/SPICA)

- Modèles physiques polychromatiques (grilles de modèles ou calcul "temps réel")

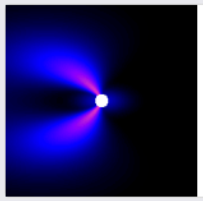
- Préparation des observations (lien outils MOIO) et analyse de données (SUV, reconstruction d'images, model-fitting)

- Outils d'analyse dédiés aux modèles astrophysiques

- Compatibilité OV, interopérabilité services JMMC

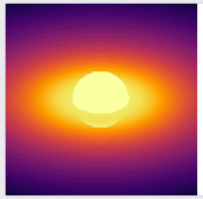
Services web AMHRA

Real time astrophysical models



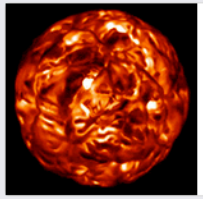
Kinematic Be disk

Model of the geometry (size and shape) and kinematics (rotation and expansion) of circumstellar, flat, rotating disks, relevant to Be stars. It is suited to interpret spectro-interferometric data obtained on emission lines formed in the disk.



Disk and stellar continuum – DISCO

Model of the continuum emission from a star surrounded by a gaseous circumstellar disk (free-free and bound-free), with partially ionized and geometrically thin disk with a physical structure given by the viscous Keplerian decretion disk model. DISCO is well suited to model Be stars.

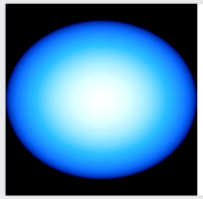


Evolved stars (RSG, AGB)

Stellar surface maps of evolved stars (RSG and AGB) computed from a 3d hydrodynamical simulation with CO5BOLD-OPTIM3D. The available model corresponds to a star similar to the famous RSG Betelgeuse.

Binary spiral model

Phenomenological model mimicking the shock caused by the collision between the winds from massive stars (e.g. WR and OB stars) and that results in dusty spirals.

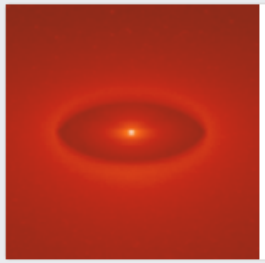


Analytical Limb-darkening Elliptical or Spherical – ALDES

ALDES provides intensity maps (images) or 1d intensity profiles for spherical or elliptical stars showing the limb darkening (LD) effect. Different LD laws are offered: uniform disk, linear, power law, quadratic, square root, logarithmic and four-parameter.

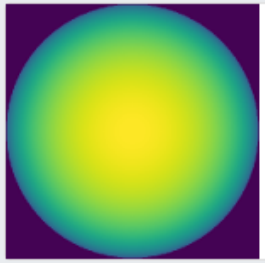
Services web AMHRA

Precalculated grids of astrophysical models



Supergiant B[e] with HDUST

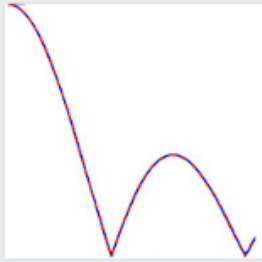
Grid of models for B[e] supergiant stars computed with the 3d Monte Carlo radiative transfer code HDUST. The non-spherical circumstellar envelope (CSE), composed of gas (hydrogen) and dust (silicate), is modelled considering a bimodal outflow description (two-component wind).



Limb-darkening with SAtlas

Grid of models providing intensity maps for spherically symmetric stars, showing the limb darkening effect. The models were computed with the SAtlas model stellar atmospheres for several spectral bands. Data is provided for FGK dwarfs and red giants.

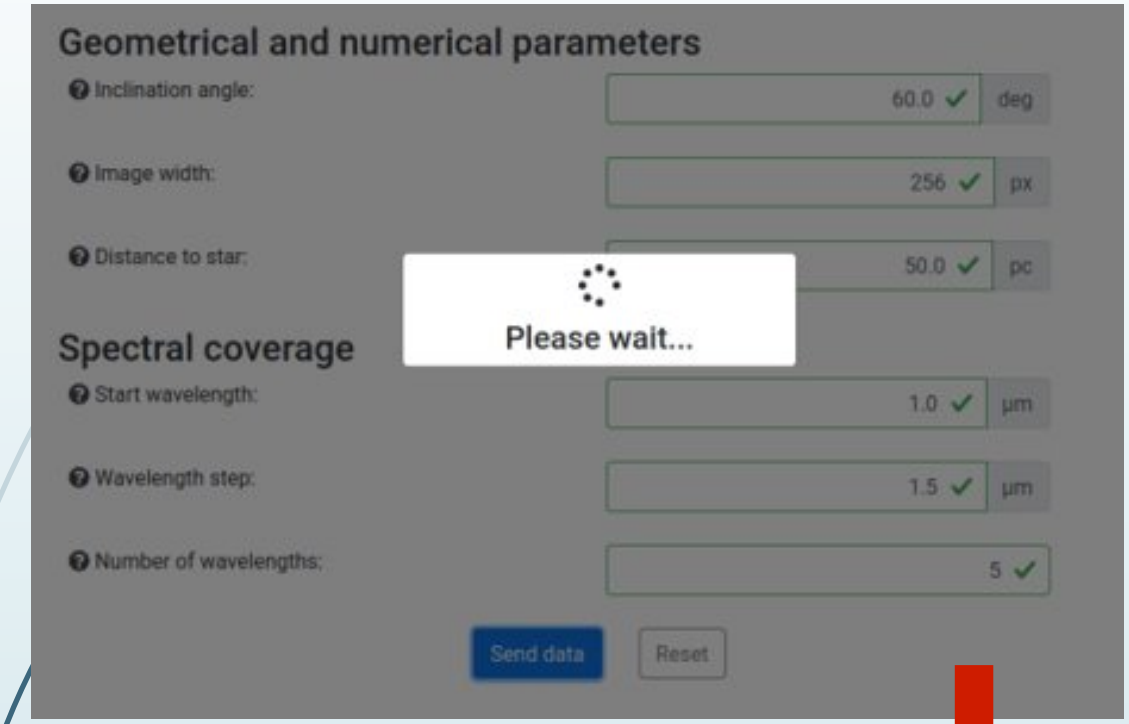
Analysis and model fitting tools



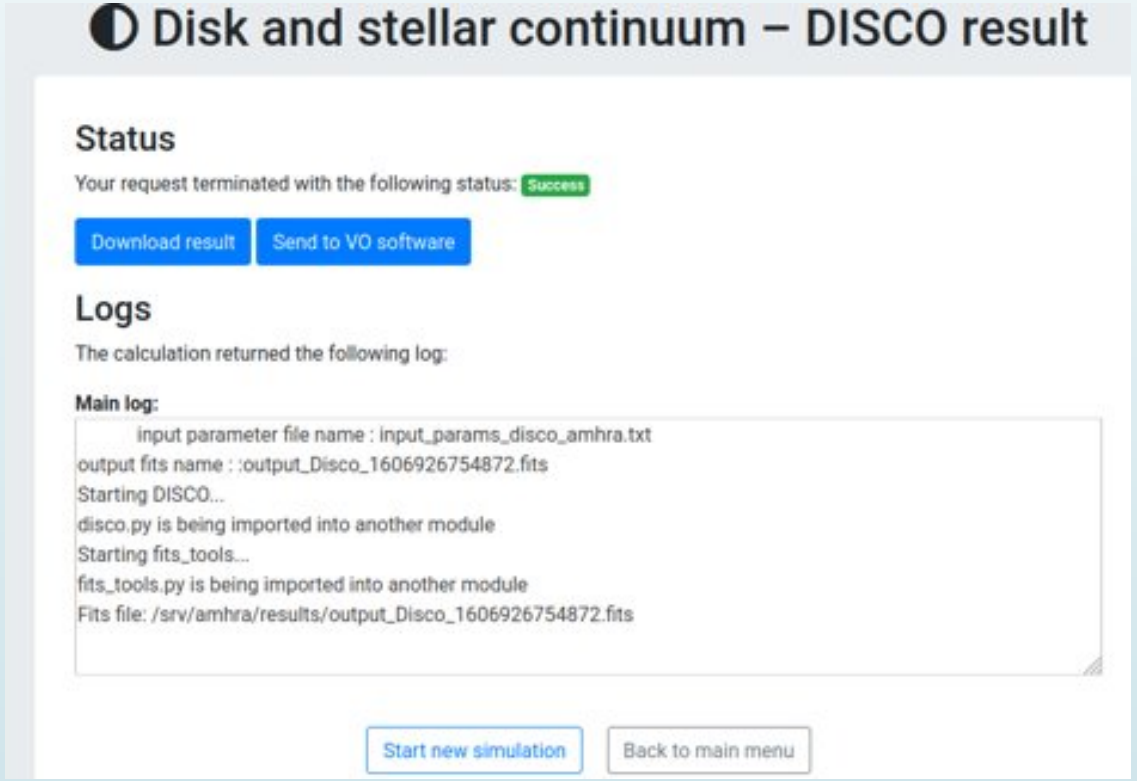
OIFits modeler

This tool compares real interferometric observations to observables (squared visibilities, closure phases...) calculated by ASPRO routines from a user-provided image (intensity map). Images from AMHRA models or other user-provided images can be used.

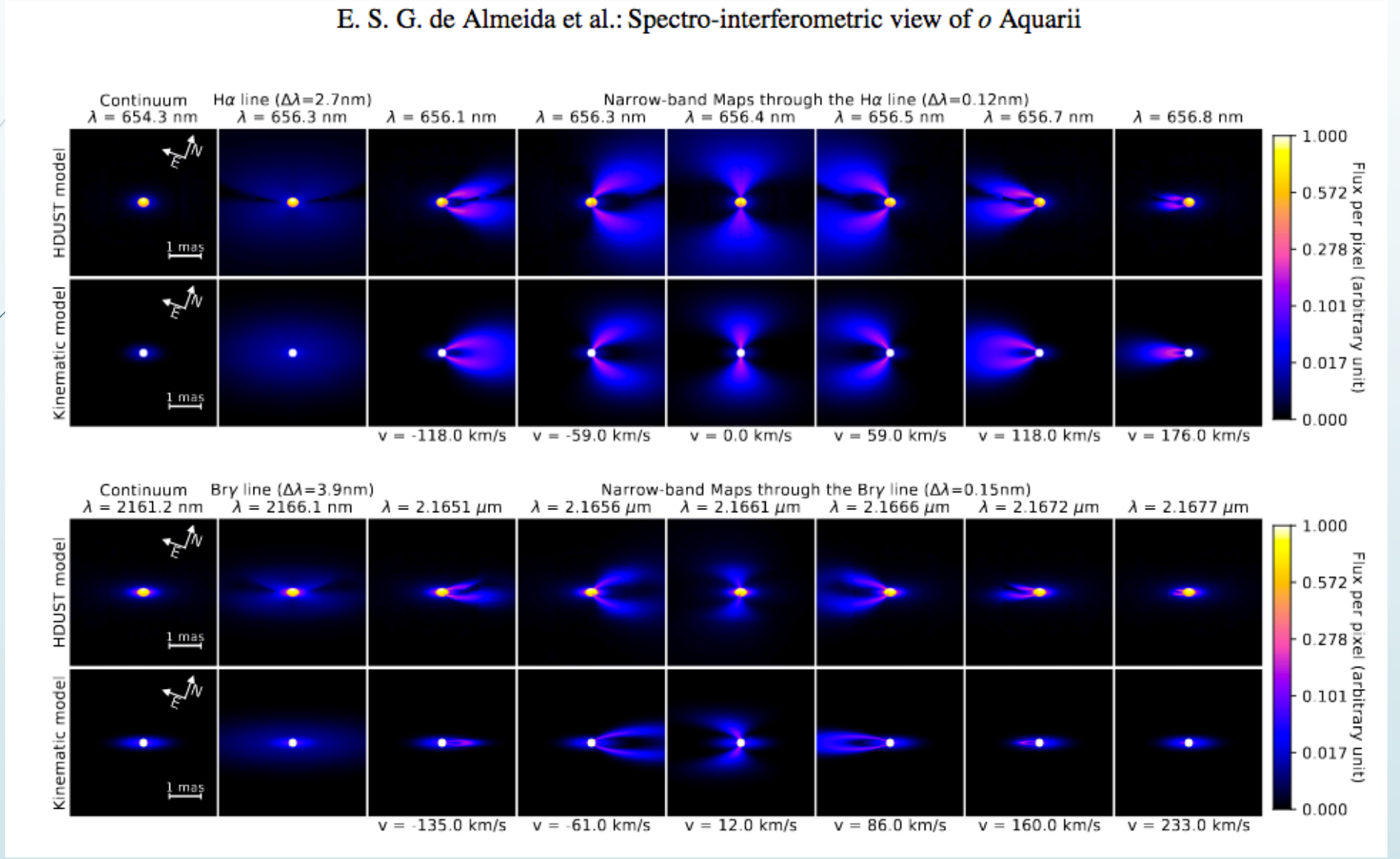
Services web AMHRA



Cubes d'images (x,y, lambda) au format .fits compatibles avec ASPRO/JMMC

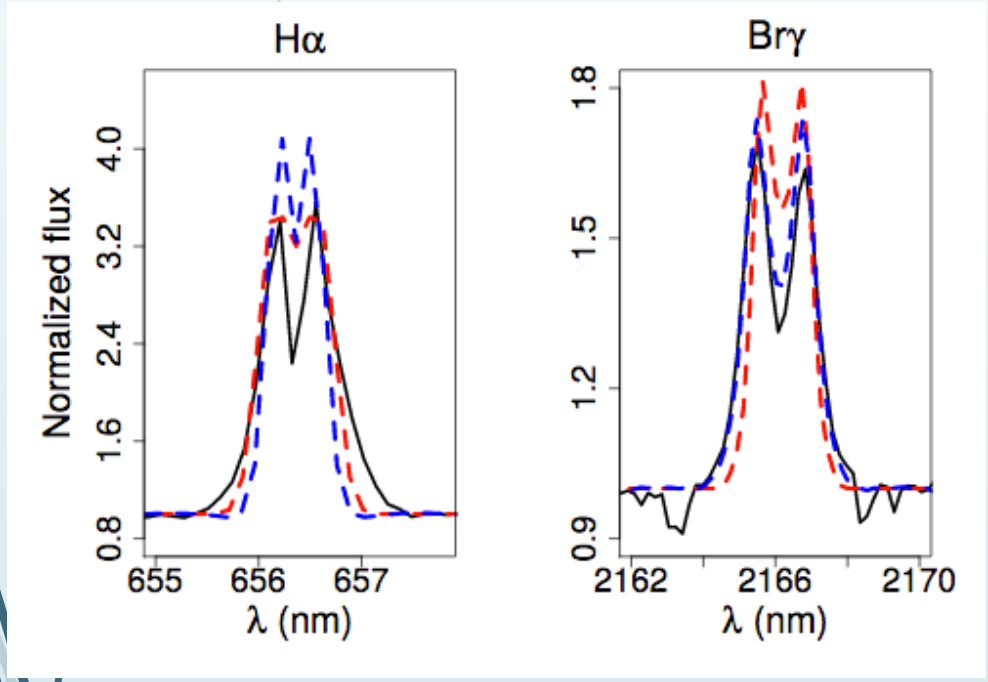


Kinematic Be disk **Modèle développé par A.Meilland**



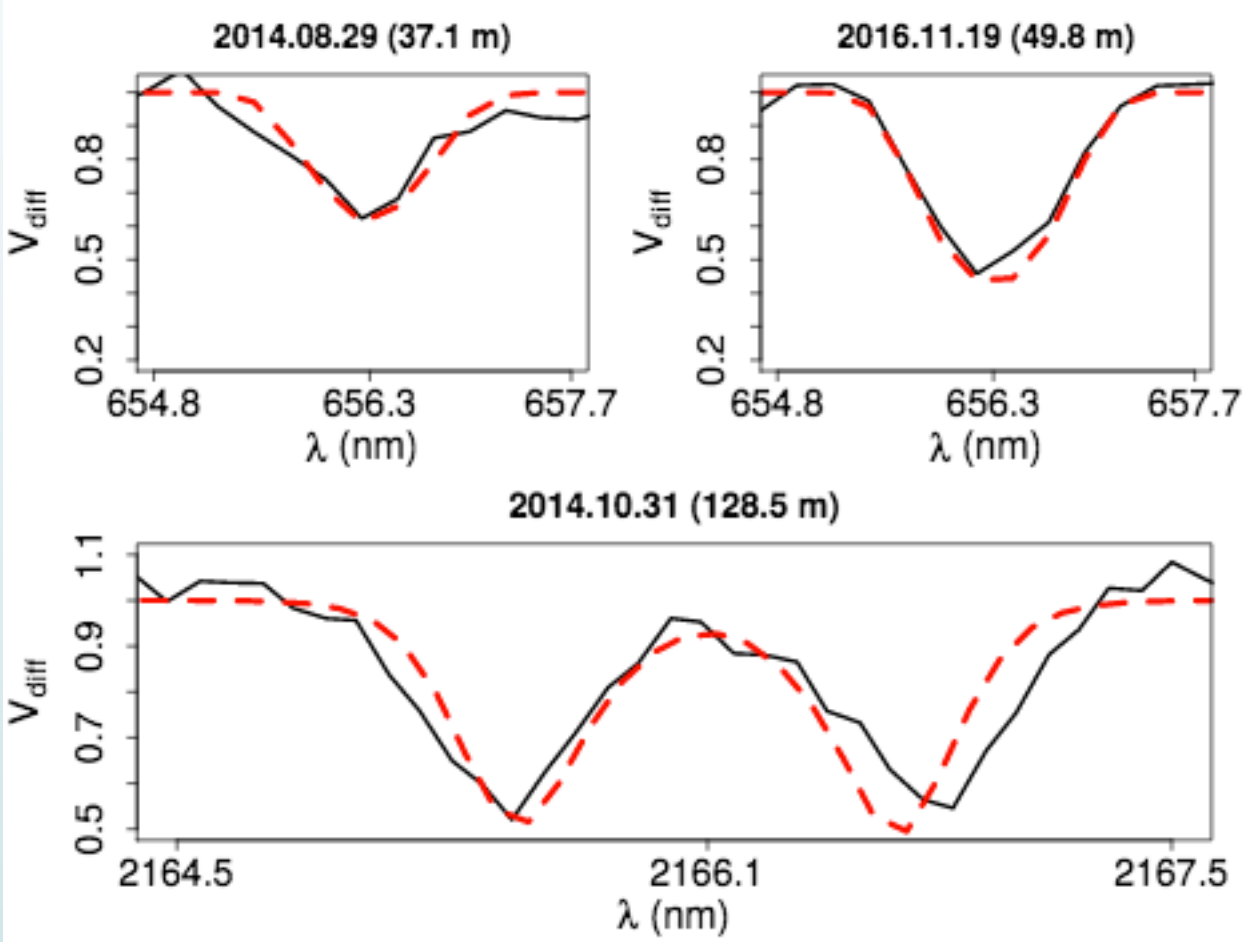
Kinematic Be disk **Modèle développé par A.Meilland**

Profils de raies spectrales



de Almeida et a. A&A 636, A110 (2020)

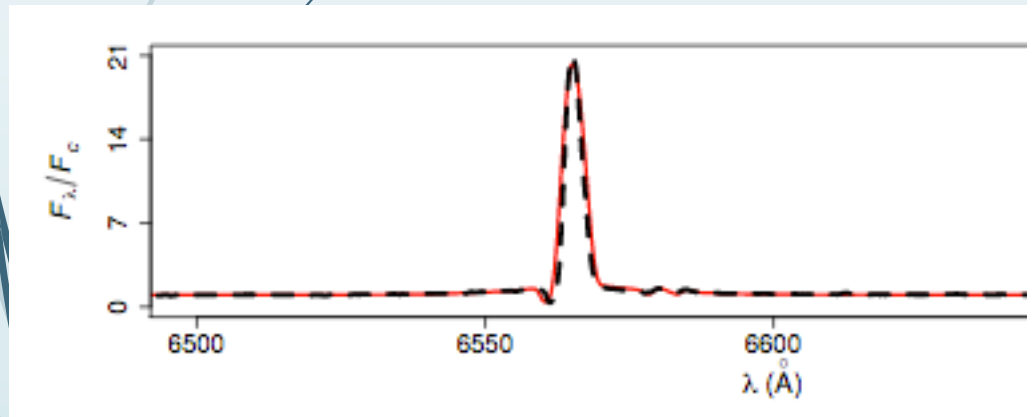
Observables interférométriques



Autres modèles envisagés (en cours)

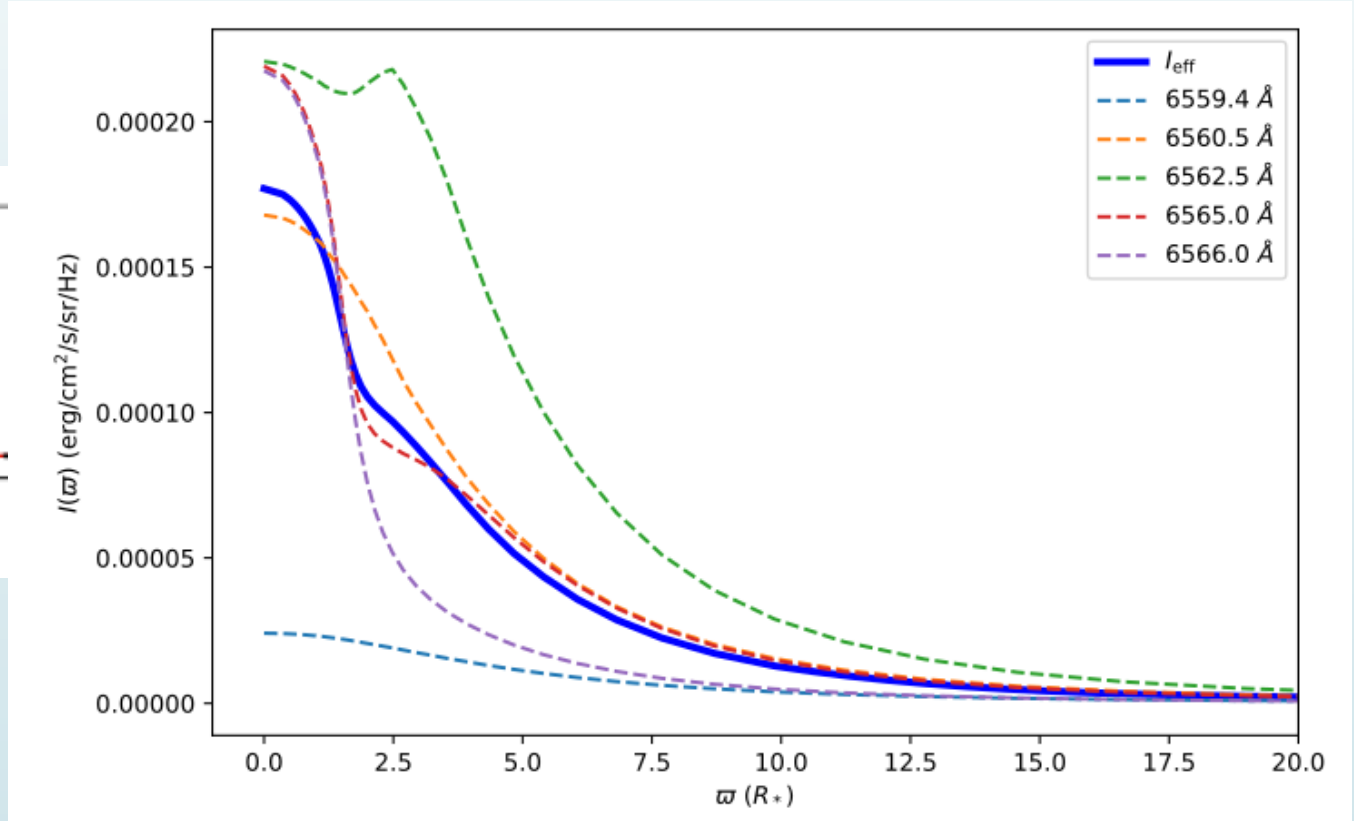
Modèles 1D d'étoiles massives avec vent et perte de masse (code CMFGEN)
Contributeurs: E.S.G. de Almeida, F. Martins, A.Palacios, A. Domiciano de Souza

Flux (spectres)



Rivet et al. 2020, MNRAS

Calculer des profils 1D d'intensité spécifique à partir de >300 modèles CMFGEN de la base Pollux

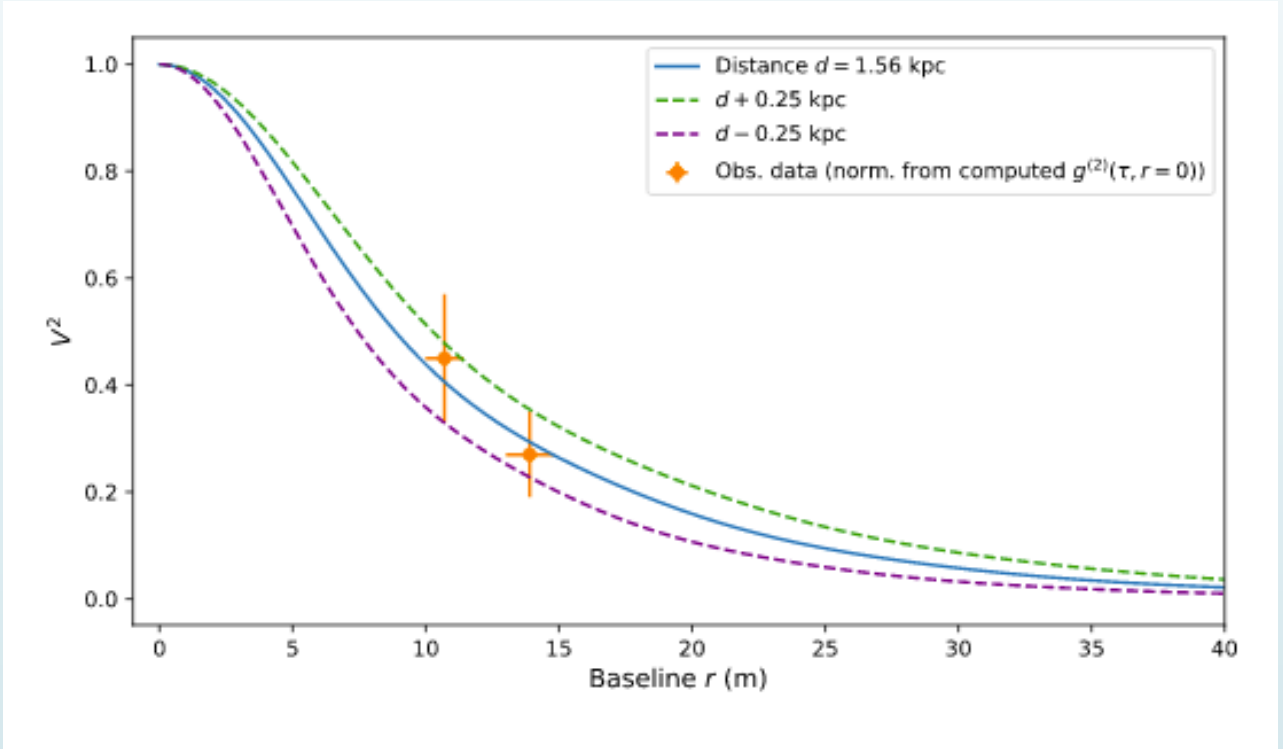


Autres modèles envisagés (en cours)

Modèles 1D d'étoiles massives avec vent et perte de masse (code CMFGEN)
Contributeurs: E.S.G. de Almeida, F. Martins, A.Palacios, A. Domiciano de Souza

Contraste des franges interférométriques (visibilité V) calculé par la transformé de Hankel des profils d'intensité 1D:

$$V^2 = \left| \frac{\int_0^\infty I_{\rm eff}(\rho) J_0(2\pi\rho q) 2\pi\rho \, {\rm d}\rho}{\int_0^\infty I_{\rm eff}(\rho) 2\pi\rho \, {\rm d}\rho} \right|^2$$



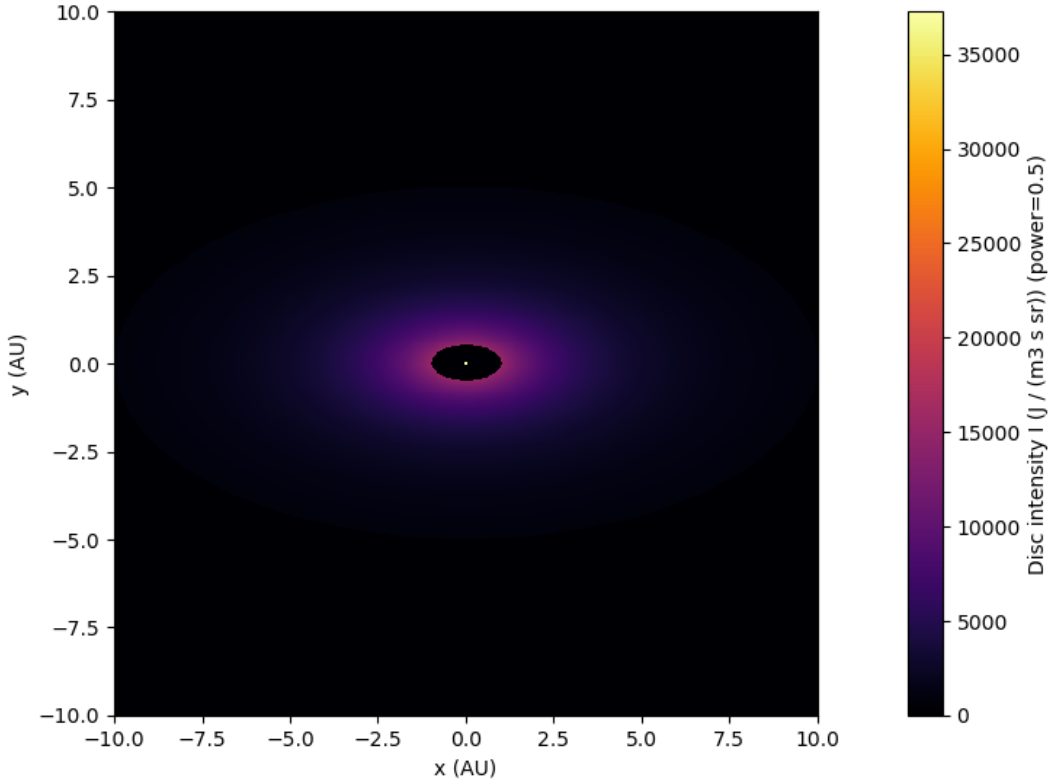
Rivet et al. 2020, MNRAS

Autres modèles envisagés (en cours)

Modèles simples de disques de poussière d'étoiles jeunes (YSO)

Contributeurs: A. Matter, E. Kokoulina, A. Domiciano de Souza + MOIO/JMMC

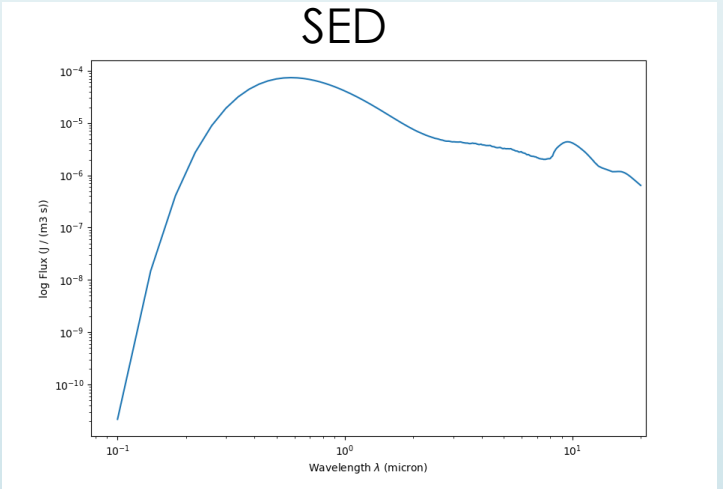
Images disque+étoile (cartes d'intensité à différentes longueurs d'onde)



Intensité 2d calculé à partir d'une loi analytique pour la température et la densité de surface avec une opacité de poussière prédéfinie.

$$T(r) = T_{\rm in}\left(\frac{r}{R_{\rm in}}\right)^{p_{\rm T}} \qquad \Sigma(r) = \Sigma_{\rm in}\left(\frac{r}{R_{\rm in}}\right)^{p_{\Sigma}}$$

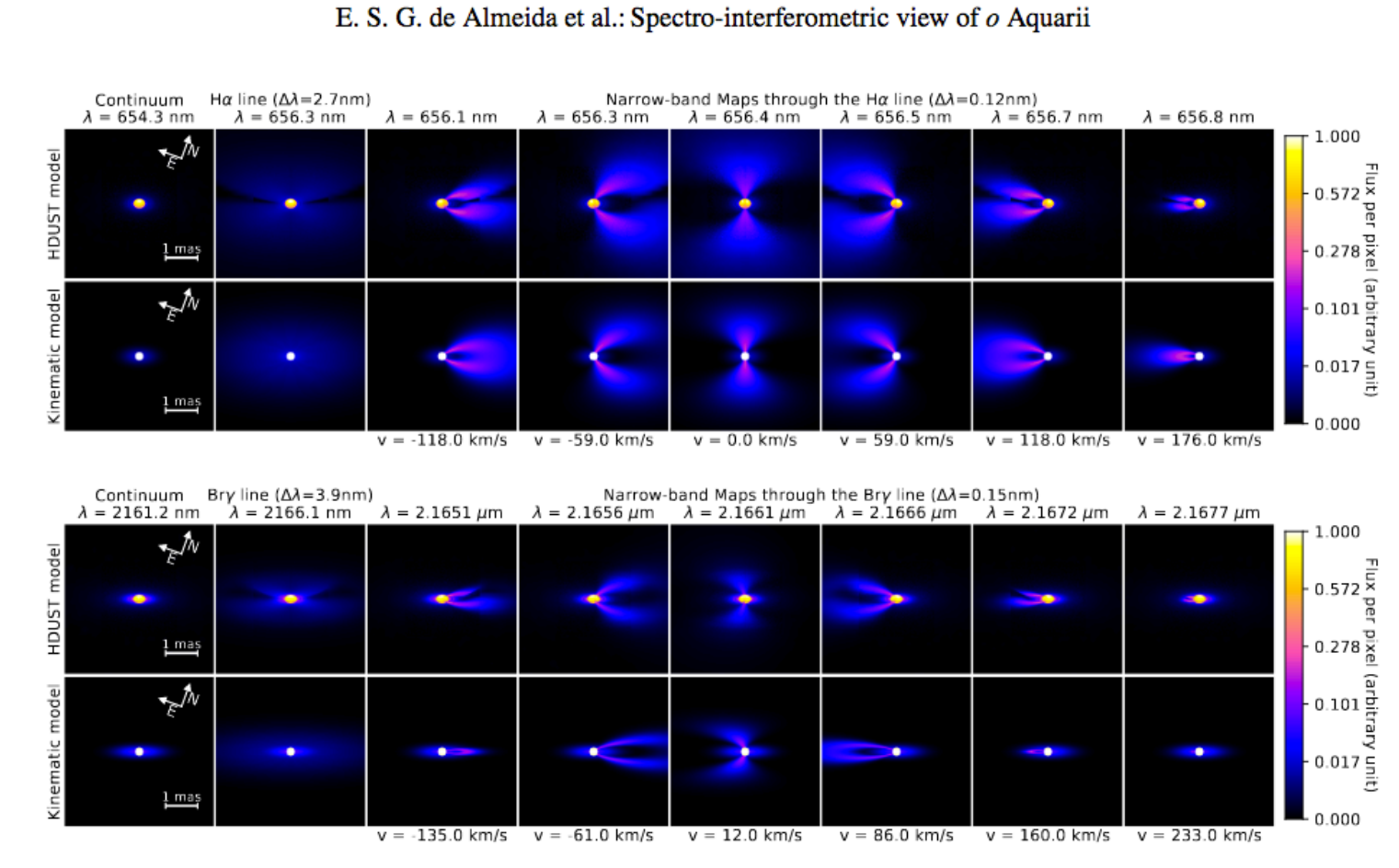
SED



Kokoulina+2021 & Matter+2014

Autres modèles envisagés (en cours)

Grille de modèles d'étoiles Be (code HDUST : transfert radiatif 3D Monte Carlo)
Contributeurs: A.C.Carciofi, A. Domiciano de Souza et al.



Limb-darkening models (présent et futur)

- **ALDES**: lois analytiques (uniform disk, linear, power law, quadratic, square root, logarithmic and four-parameter law)
- **SATLAS** : grille de profils d'intensité précalculés (papers Neilson & Lester)
- **Futur** : **Profils MARCS ou autres ? (PLATO+CHARA/SPICA)**