The Baade-Wesselink analysis of Type II Cepheids

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Research in 2023:

- **Type II Cepheids Baade-Wesselink analysis** (paper almost finished)
- Anomalous Cepheids Period-Luminosity relations and Baade-Wesselink analysis (paper advanced)
- CoI of JWST proposal for observing Cepheids in the galaxy from the Hubble Flow (H0 determination independent of SNIa, PI: Pierre Kervella)

Published papers:

- Nardetto et al., HARPS-N high spectral resolution observations of Cepheids. II. The impact of the surface-brightness color relation on the Baade-Wesselink projection factor of η Aql, 2023, A&A
- Narloch et al., “Period-Luminosity Relations for Galactic Classical Cepheids in the Sloan Bands”, 2023, ApJ
- Zgirski et al., New Near-infrared Period-Luminosity-Metallicity Relations for Galactic RR Lyrae Stars Based on Gaia EDR3 Parallaxes, 2023, ApJ
- Bras et al., “The Baade-Wesselink projection factor of RR Lyrae stars -- Calibration from OHP/SOPHIE spectroscopy and Gaia DR3 parallaxes”, A&A (accepted)

Conferences:

- IAU Symposium 376 “At the cross-roads of astrophysics and cosmology: Period–luminosity relations in the 2020s”, contributed talk, 17-21.04.2023, Budapest

Other activities:

- Many things related to Rolf Chini Cerro Murphy Observatory (OCM) development
- OCM inauguration (talk, TV and radio interviews)
- Popular talk during CAMK open day

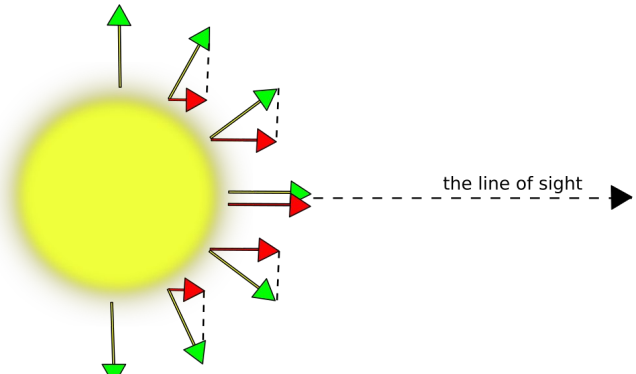
The Baade-Wesselink method

- Distance measured from angular diameter variations (inferred from photometry in two photometric bands and surface brightness-color relation) and physical radius displacement over the pulsating phase

- Physical radius displacement can be measured by integrating the radial velocity curve if the projection factor (p) is known

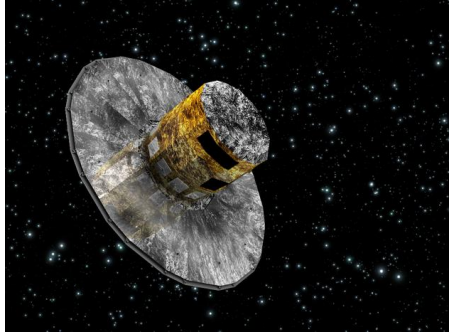
- **We can invert the BW method and measure projection factors of pulsating stars with known distances and thus calibrate the method**

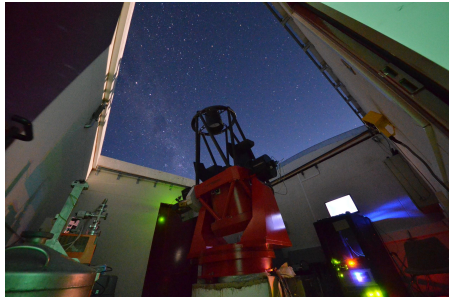
$$V_{measured} = V_{pulsations} / p$$

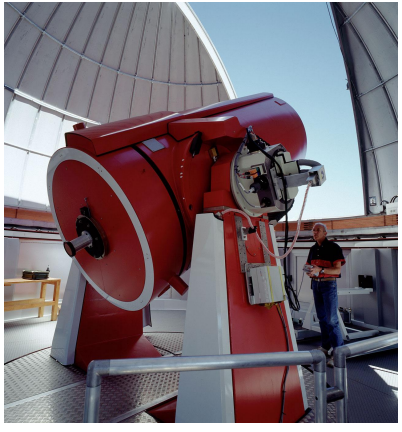


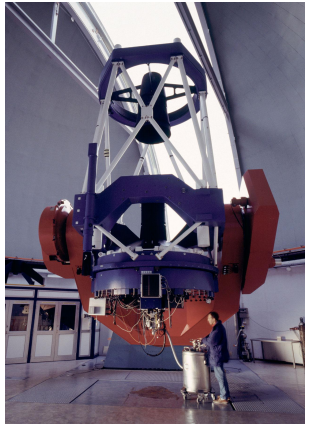
Photometry, spectroscopy, distances

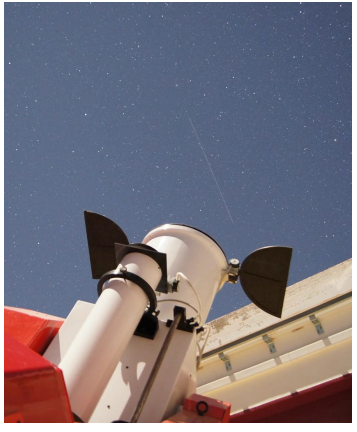
- Sample of nearby (<5kpc) Type II Cepheids
- Optical photometry in V from VYSOS 16, near-infrared photometry in Ks from IRIS
- Radial velocities measured from FEROS, CORALIE, HARPS and UVES spectra
- Distances from Gaia DR3 parallaxes

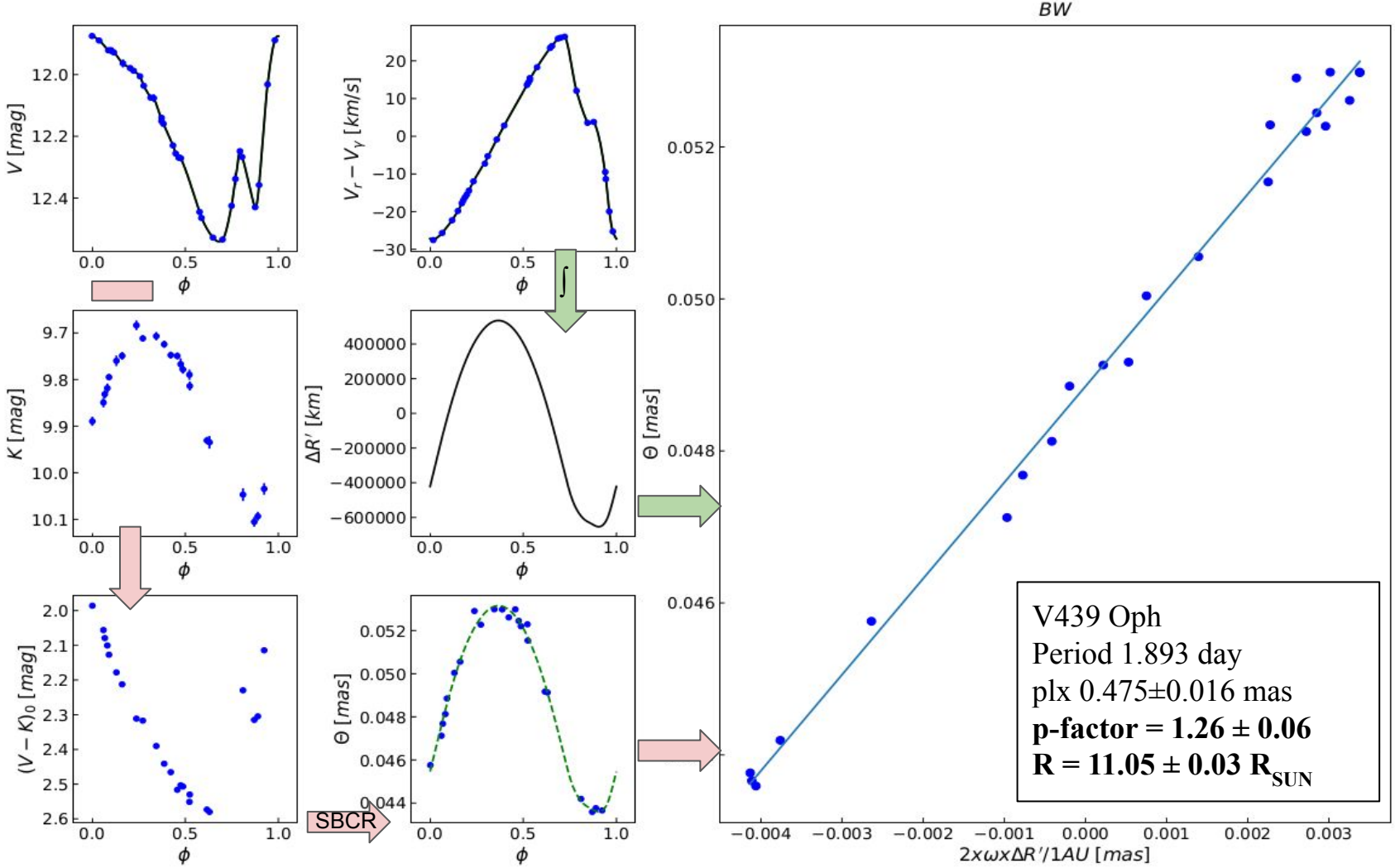


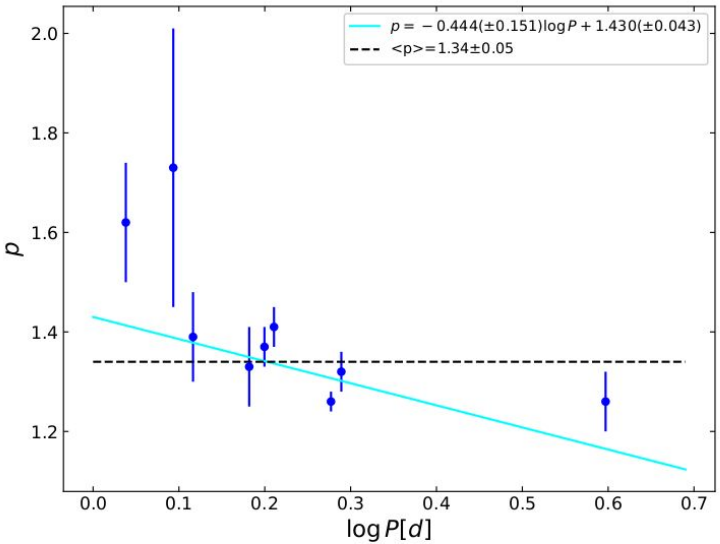


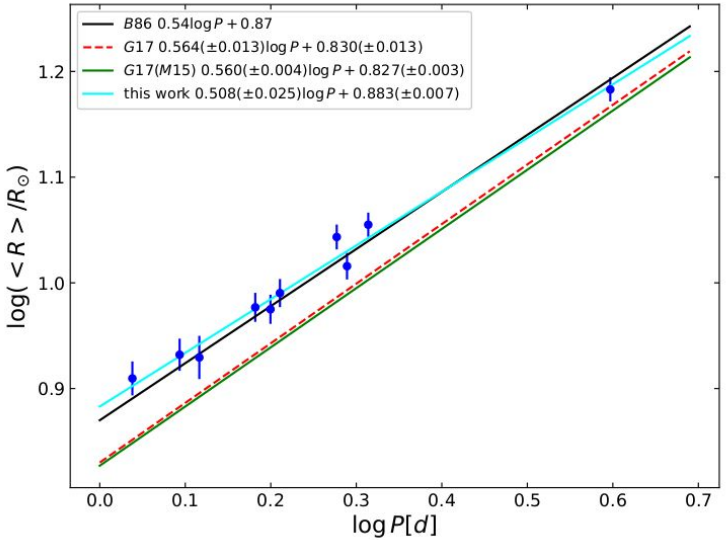







BW
V [mag]
$V_r - V_\gamma$ [km/s]
K [mag]
ΔR′ [km]
Θ [mas]
$(V-K)_0$ [mag]
Θ [mas]
SBCR
ϕ
$2x\omega x\Delta R'/1AU$ [mas]
V439 Oph
Period 1.893 day
plx 0.475±0.016 mas
p-factor = 1.26 ± 0.06
R = 11.05 ± 0.03 R_{SUN}





Systematic uncertainty ~0.05 (p-factor) and $0.2R_{sun}$ (radius) contains: V and K photometric zero point uncertainty, E(B-V) uncertainty, parallax uncertainty and surface brightness uncertainty. Dominating sources of systematic uncertainty: surface brightness and parallax (parallax errors will be smaller in the Gaia DR4).

We selected new Type II Cepheids (~50 in total) -> better precision -> better distances of distant Type II Cepheids from BW method