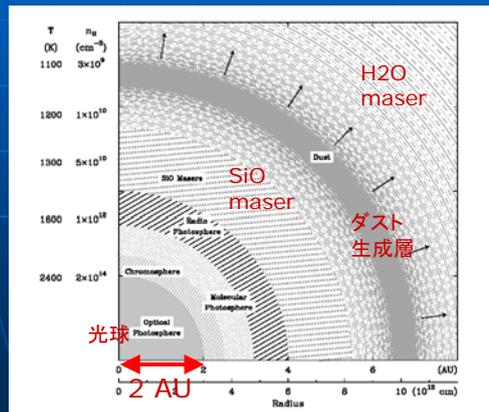


AGB星の星周領域

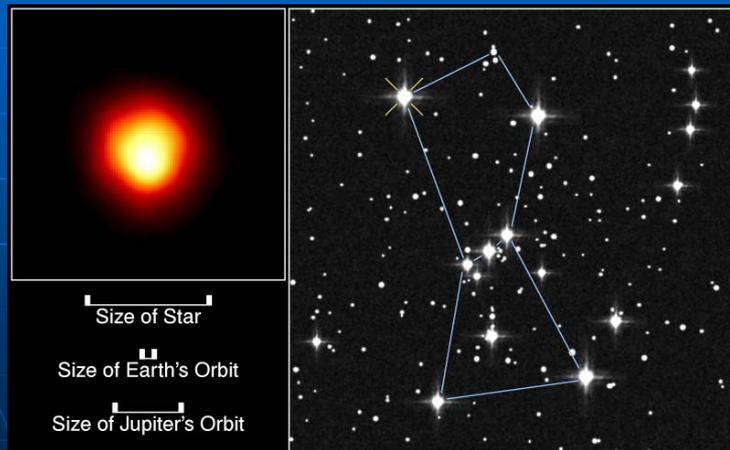
- AGB星: 年老いた星。質量放出をしながら脈動している。



AGB星の星周領域の模式図

星は分解できる？

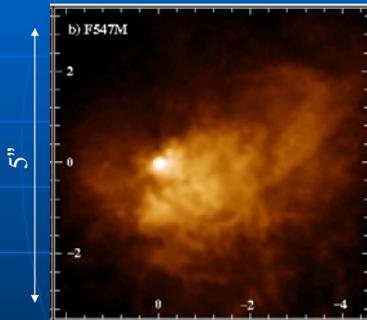
- α Ori: 光学観測で星が点でない数少ない例



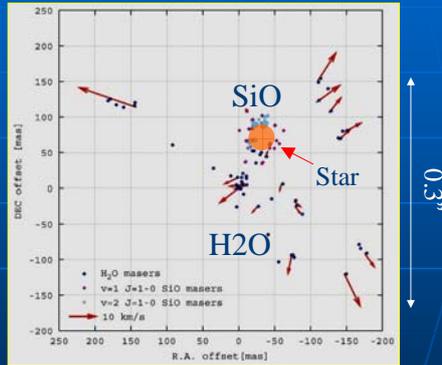
Atmosphere of Betelgeuse
PRC96-04 · ST ScI OPO · January 15, 1995 · A. Dupree (CfA), NASA

VY CMaのメーザー

- VY CMa: 進化した大質量星(超新星爆発目前?)



HSTで見た質量放出
(Smith et al. 2001)



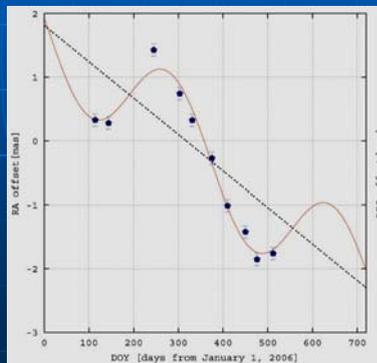
H2OとSiOメーザー
(Choi et al., VERA)

SiO:ダスト生成層の内側(加速なし), H2O:外側(加速あり)

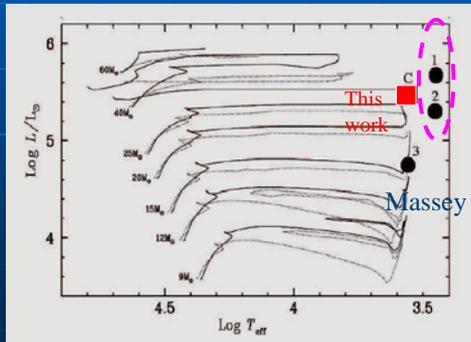
VY CMaとHR図

- 年周視差による距離: $D = 1.1 \pm 0.1$ kpc, (VERA)
- VERAおよびMassey et al.(2006)の結果からHR図上での位置がほぼ確定。初期質量25太陽質量

in Hayashi's
Forbidden area



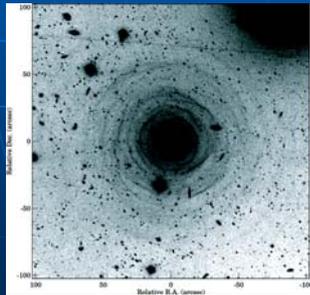
H2Oの位置変化(年周視差)



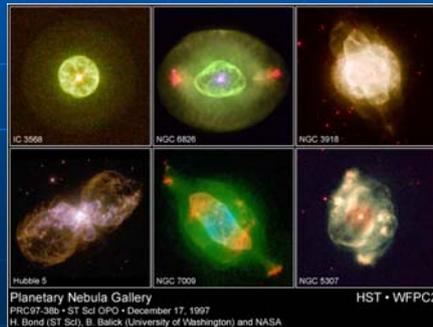
HR図上での位置

星の末期の対称性の破れ

- 太陽のような恒星： 基本的に級対称
- 星の最後(惑星状星雲, 超新星)： 非対称
AGB段階で非対称性が発現する？



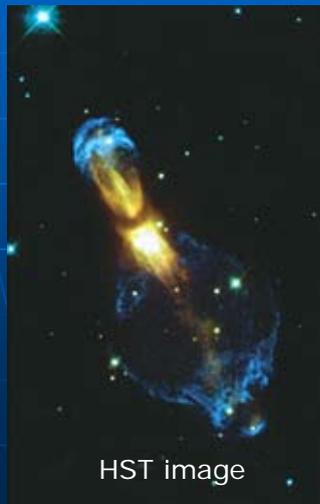
IRC+10216の対称なダストシェル



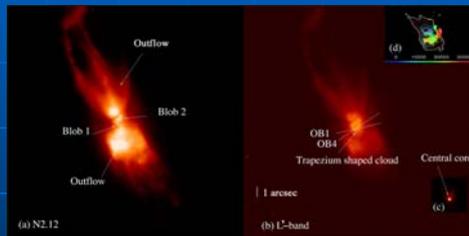
双極的な惑星状星雲

Calabash Nebula OH231.8+4.2

- Bipolar Nebular + AGB Star QX Pub



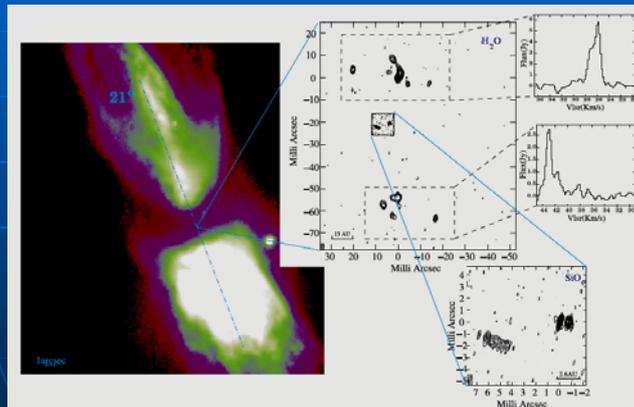
HST image



Matsuura et al. (2006)

Masers in OH231.8

- H₂O jet + SiO Disk ?

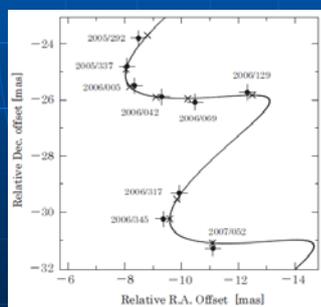


Desmurs et al. (2007)

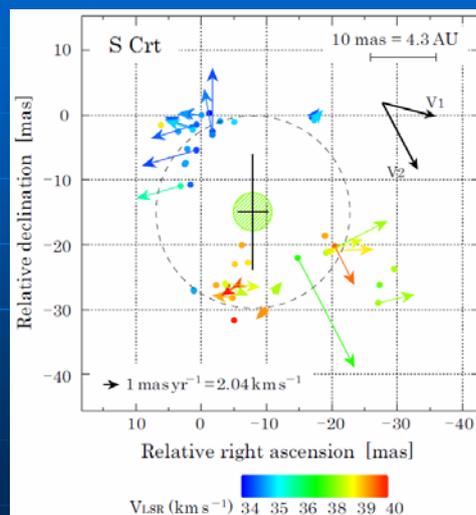
H₂O in S Crt

Nakagawa et al. (2008)

- Bipolar structure
- Maser distribution at radius of 5 – 10 AU
- Distance 430 +/- 25 pc
- photosphere 260 ± 20 R_{sun}

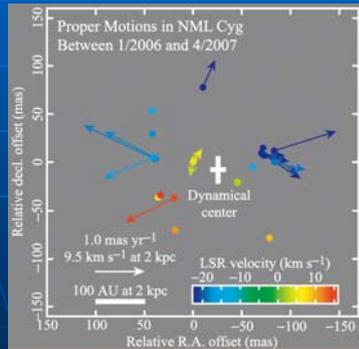


VERA
 $\mu = 2.33 \text{ mas err } 0.3$

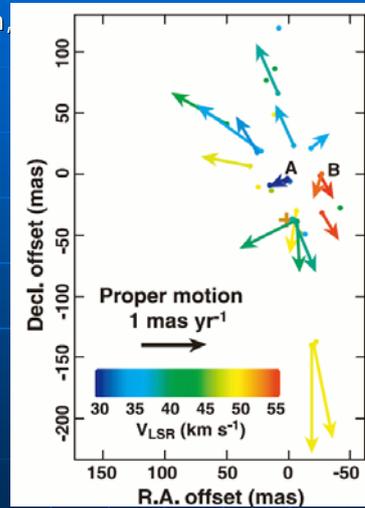


H2O in NML Cyg / IRC-10414

- H2O maser shows bipolar distribution, and maser proper motion confirmed bipolar expansions of H2O masers



NML Cyg
Nagayama et al.(2008)



IRC-10414
Maeda et al.(2008)