

# Evidence for Atomic Absorption Features in the High Resolution X-ray Spectrum of the Neutron Star in Puppis A



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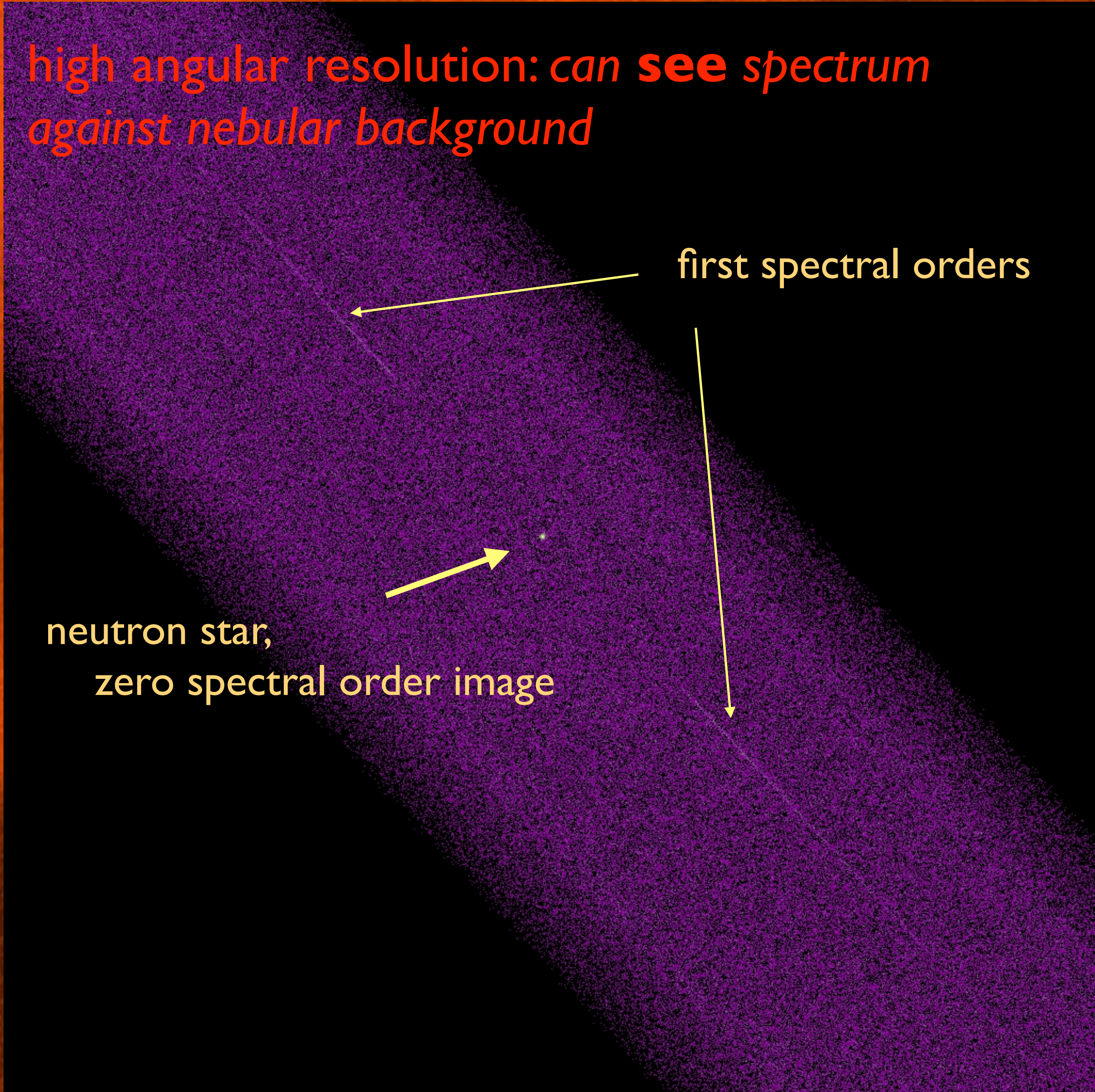
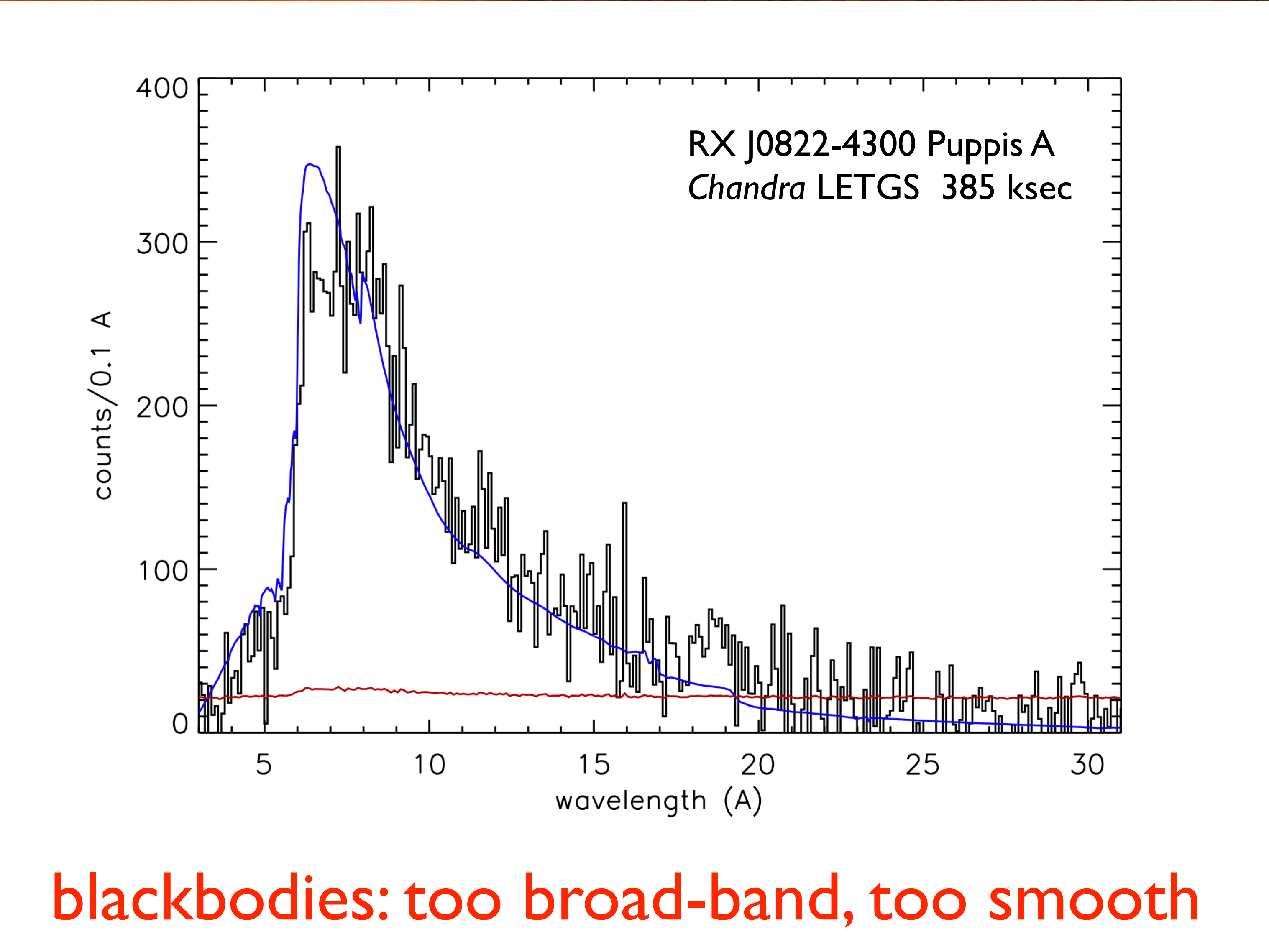
385 ksec exposure with *Chandra* LETG/HRC-S; 14 separate exposures in 2021

## Abstract

We present evidence for atomic absorption lines in the high-resolution 4-30 Å X-ray spectrum of the neutron star RX J0822-4300 in the supernova remnant Puppis A.

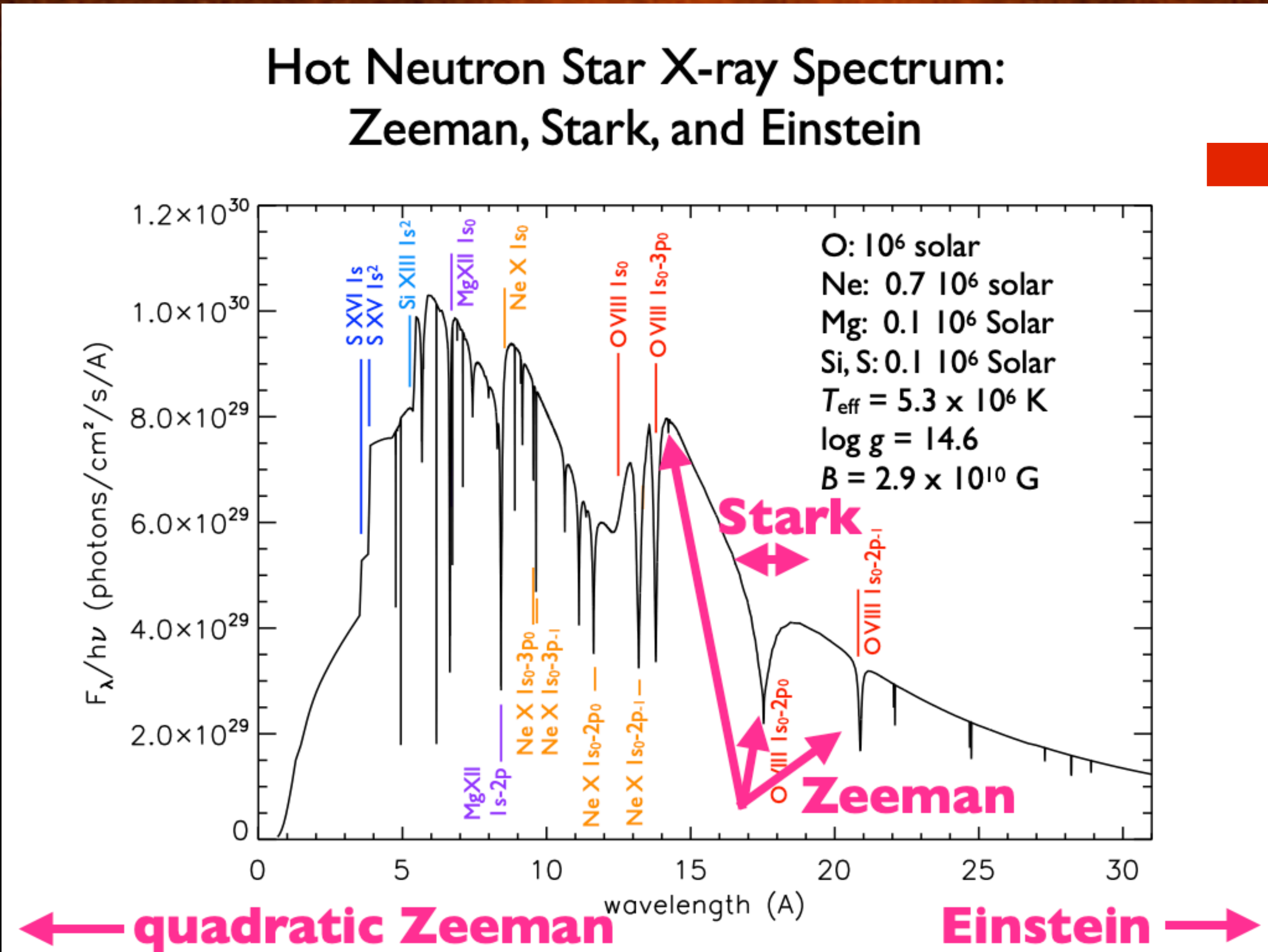
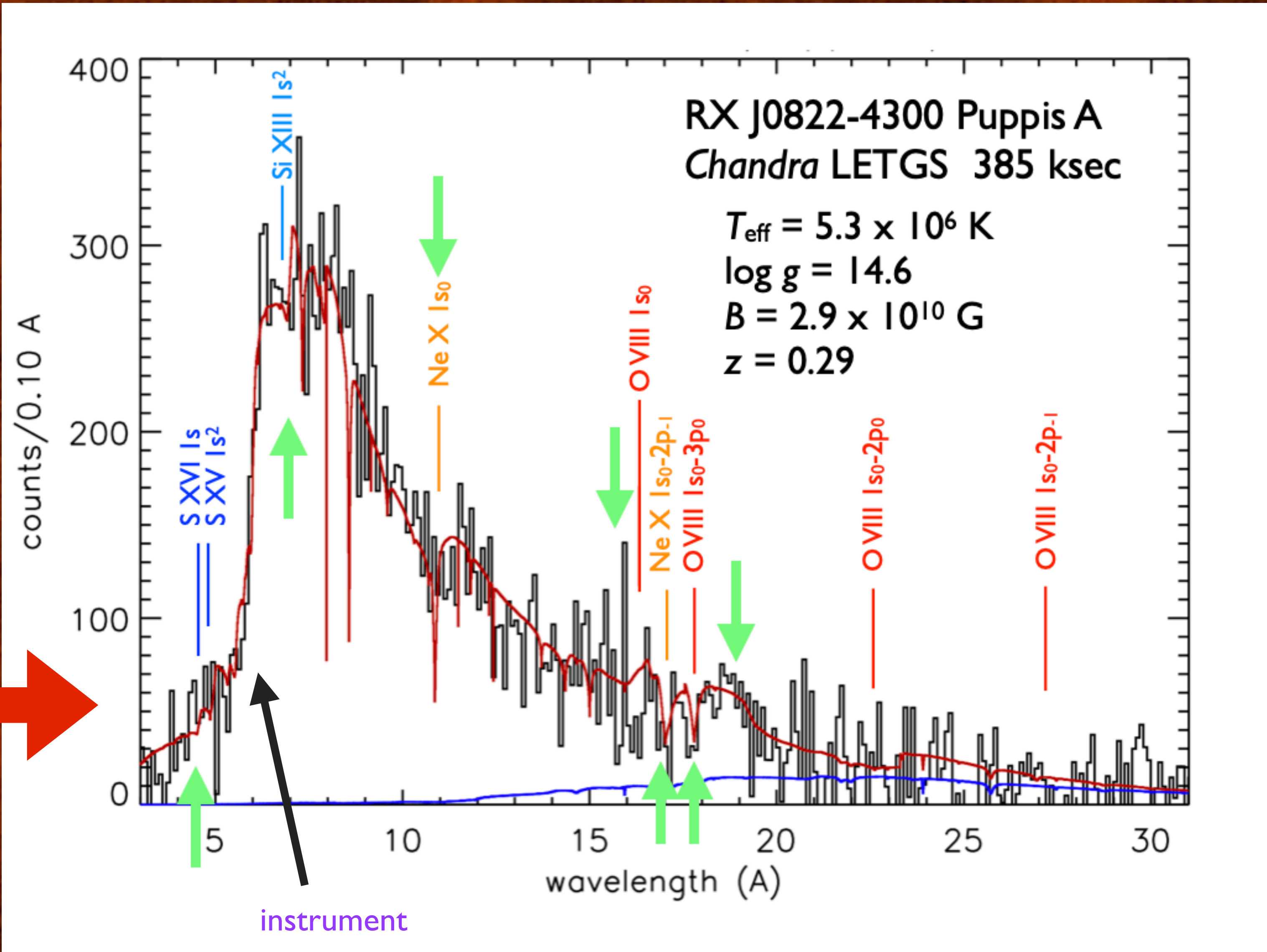
Comparison with model atmosphere calculations shows that features in the observed spectrum can be uniquely associated with redshifted and pressure-broadened transitions in highly ionized oxygen and neon. We also spectroscopically confirm the previously estimated strength of the surface magnetic dipole field; we detect both the linear and the quadratic Zeeman effect.

We derive values for both the gravitational redshift and the acceleration of gravity at the stellar surface, yielding the first purely spectroscopic estimates for the radius and mass of a neutron star.

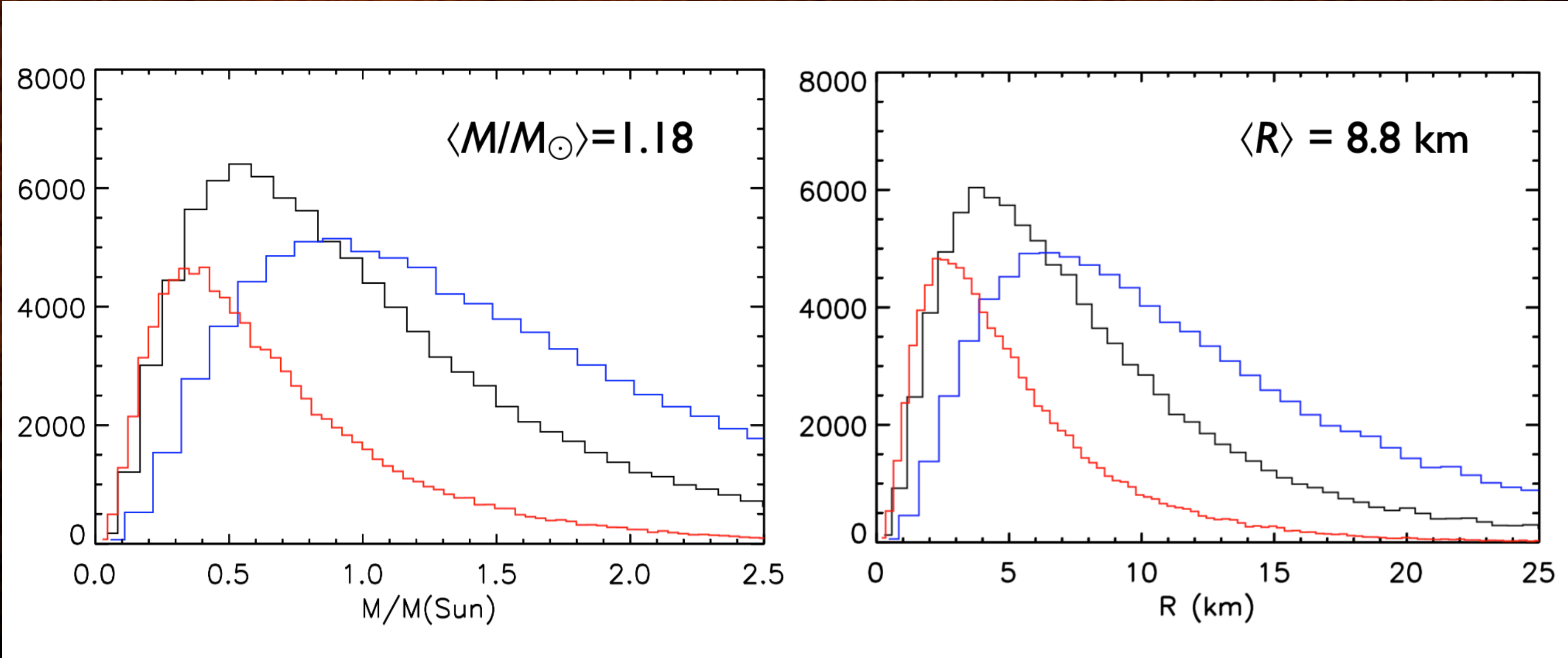


neutron star, 3000-4000 yrs old  
thermal spectrum,  $T_{\text{BB}} \sim 4$  MK  
'weakly' magnetized;  $P = 112$  ms

**gravitational redshift  $z = 0.29$**



spectroscopic mass and radius



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