



Jurassic World: The Decline of the Blackbody

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Since more than a decade, the German Astrophysical Virtual Observatory (GAVO) provides the registered Virtual Observatory (VO) service *TheoSSA* (Theoretical Stellar Spectra Access). It is dedicated to the easy access of VO users to theoretical stellar spectral-energy distributions (SEDs). These include non-local thermodynamic equilibrium (NLTE) model-atmosphere fluxes for hot, compact stars like, e.g., central stars of planetary nebulae. These SEDs replaced the coarse blackbody approximation for central stars, that had been used commonly in the last century and beyond, because reliable ionizing fluxes are mandatory for precise nebula analyses.

The Dark Side

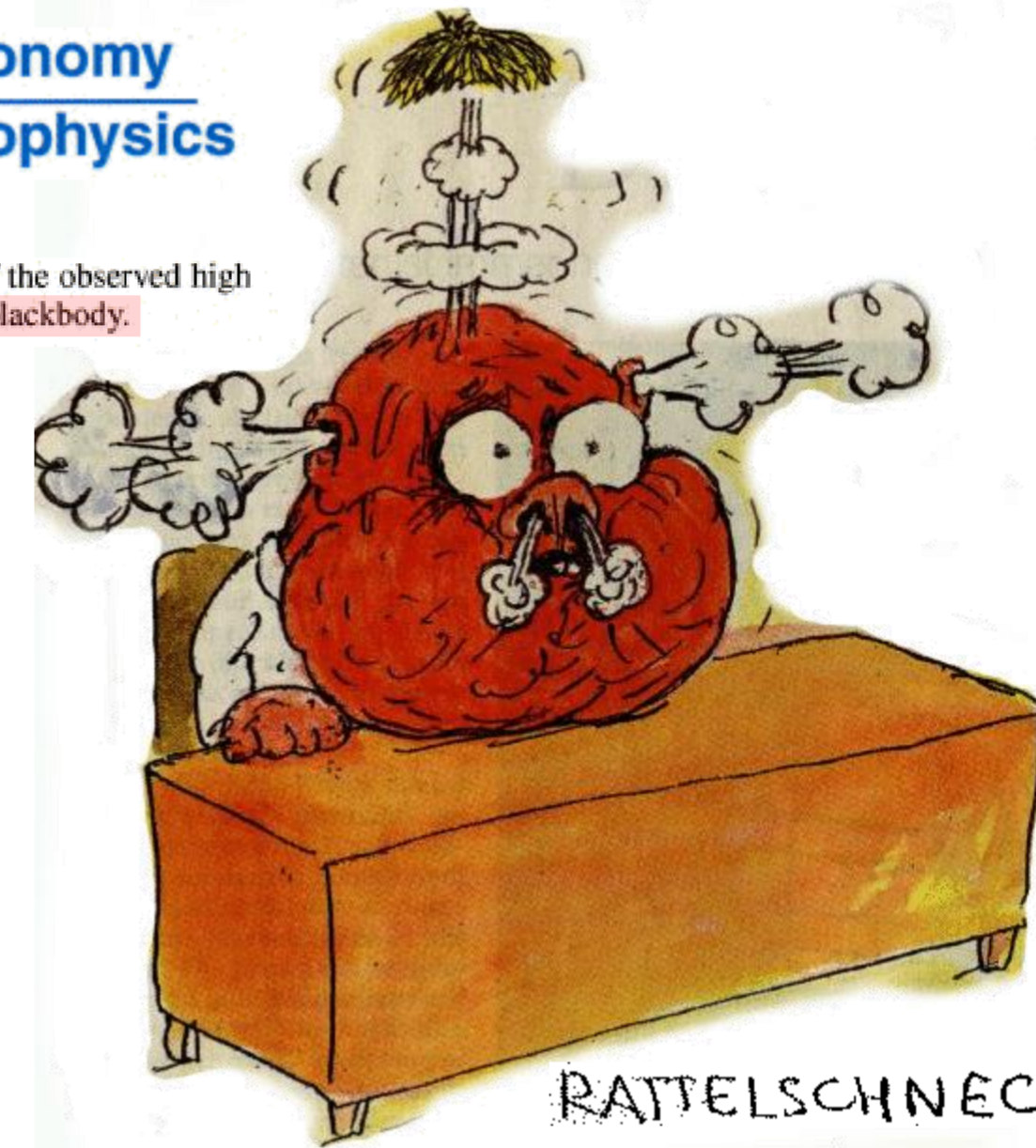
of the force is a pathway to many abilities some to consider to be unnatural.
Sheev Palpatine

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ABSTRACT
The temperature of the central star is discussed in the light of the observed high stages of ionization. The nebular information indicates that the spectrum of the star deviates considerably from a blackbody.

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Astronomy
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RATTELSCHNECK

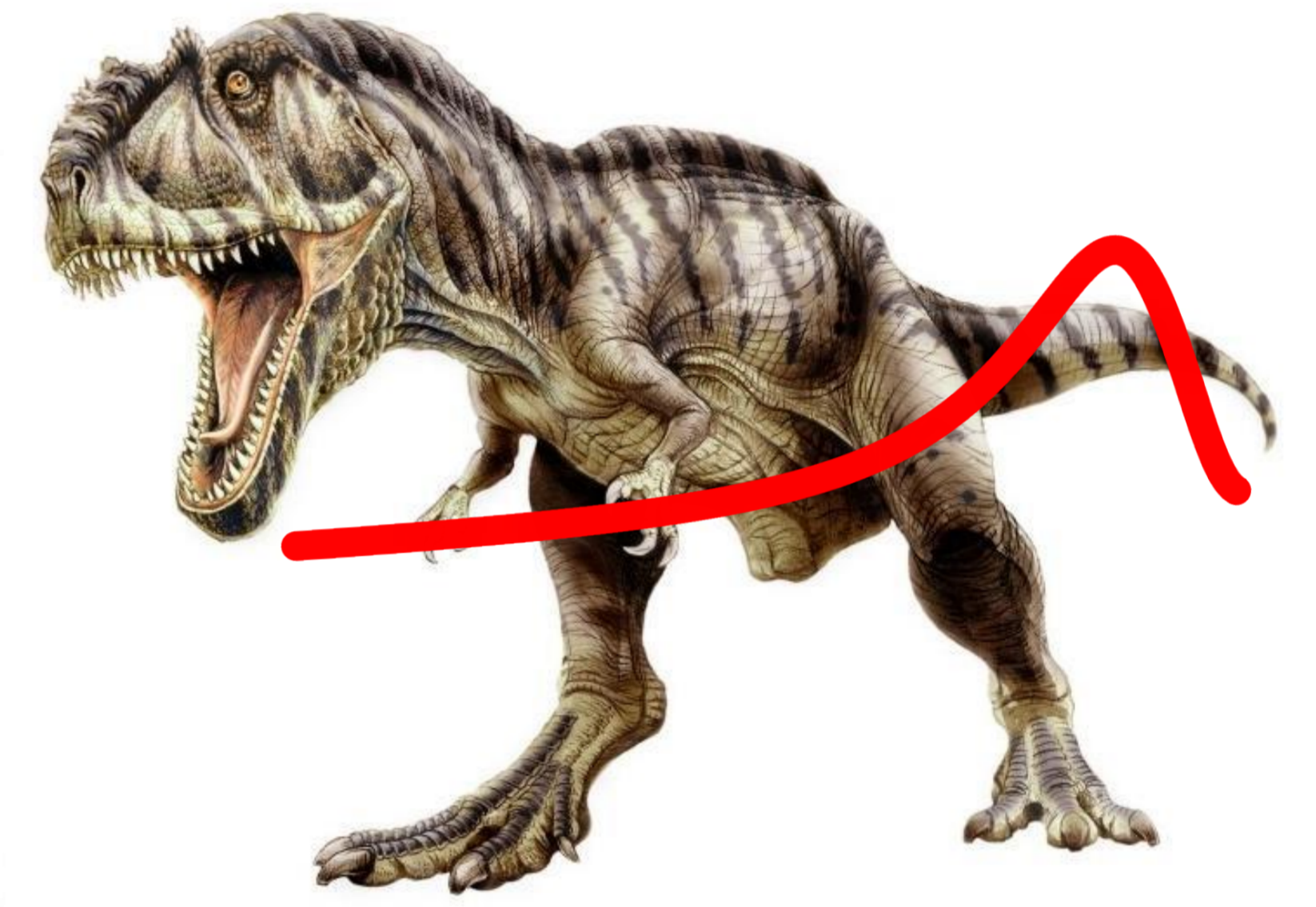


Foto: Forschungsinstitut und Naturmuseum Senckenberg

TMAP

The Tübingen Model-Atmosphere Package was created in the 1980s and is continuously developed since then. With *TMAP*, NLTE model atmospheres for hot, compact objects like, e.g., CSPN, (pre-)white dwarfs, and neutron stars can be calculated. Effective temperatures between 20 kK and more than 10 MK, surface gravities between $\log g = 4$ and 15 can be chosen and elements from hydrogen to barium can be included into the calculations. *TMAP* considers:

- hydrostatic and radiative equilibrium
- plane-parallel or spherical geometry
- elements H – K
 - about 1500 individual atomic levels, about 4000 lines
- elements Ca - Ba (iron-group and trans-iron elements)
 - hundreds of thousands of levels, 300 millions of lines

TheoSSA

TheoSSA (<http://dc.g-vo.org/theossa>) provides easy access to more than 150000 spectral energy distributions for hot, compact stars based on our *TMAP* model-atmosphere calculations. It is controlled via a web interface where fundamental parameters like T_{eff} or $\log g$ are chosen (Fig. 1). A table of available SEDs is given as result (Fig. 2). Selected SEDs can be downloaded. Newly calculated SEDs (*TMAW*) are automatically ingested. With this service, e.g., spectral analyses can be performed the easy way.

Fig. 1: Web interface of *TheoSSA*.

TMAW

If a requested SED is not available, it can be calculated via *TMAW*, the *TMAP* web interface (<http://astro.uni-tuebingen.de/~TMAW>). Without detailed knowledge of the atmosphere code, individual models and even extensive SED grids can be calculated, considering opacities of the elements H+He+C+N+O+Ne+Na+Mg. Stellar parameters and e-mail address have to be entered and the result will be sent by e-mail within some days.

TMAD

The model-atom database *TMAD* (<http://astro.uni-tuebingen.de/~TMAD>) provides ready-to-use model atoms including level energies and radiative and collisional transition data. Presently, it includes 31 elements from H to Ba. Complete model atoms are available for model-atmosphere and for SED calculations (incl. fine-structure splitting).

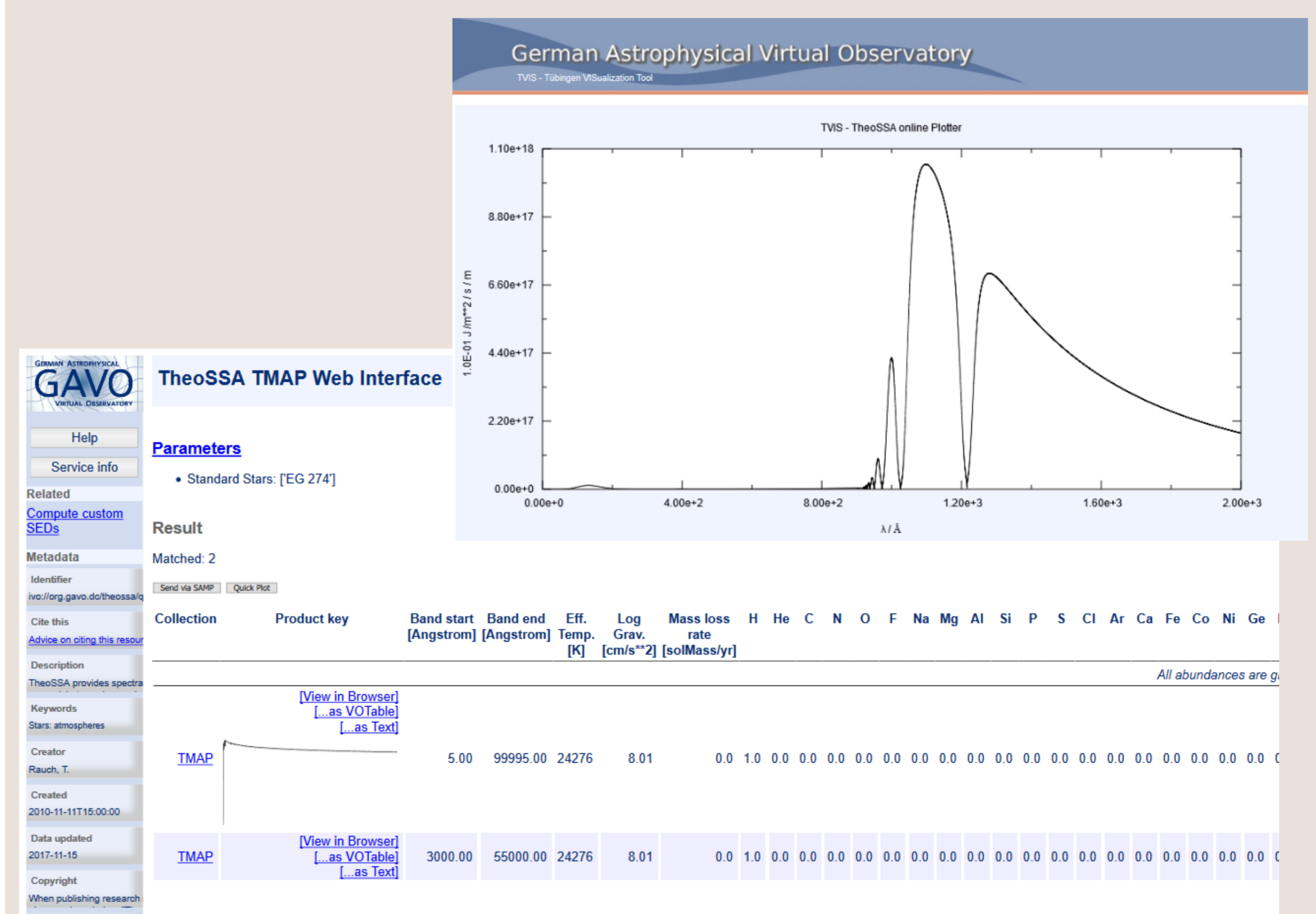


Fig. 2: An example SED (EG 274) and a part of its meta data provided by *TheoSSA*.