Modeling EXpanding Ionized ClOuds

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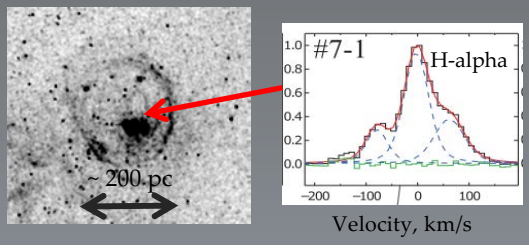
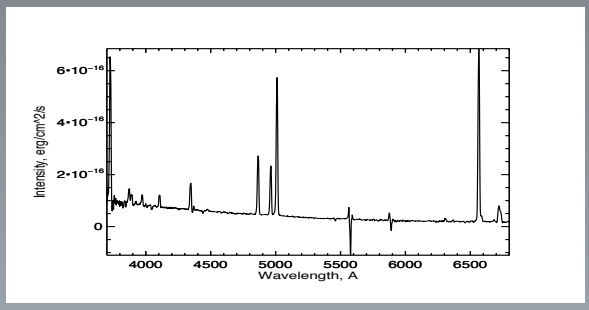
Introduction

Stellar feedback plays important role in the regulation of the ISM via photoionization, stellar winds and supernovae explosions. It lead to formation of super-bubbles with sizes up to several hundreds of parsecs that surround the young star clusters. One of the interesting examples of such super-bubbles was identified in IC2574 galaxy in Egorov et al. (2014). It reveals high expansion velocity, which usually correspond to energetic central sources like WR, SNR etc., but only poor OB-association was identified inside this region. Here we tried to compute photoionization model and reproduce the observational emission line ratios and line-of-sight velocity distribution. The aim was to find, what kind of sources provide enough energy to ionize the nebula and drive its expansion.

Observational Data

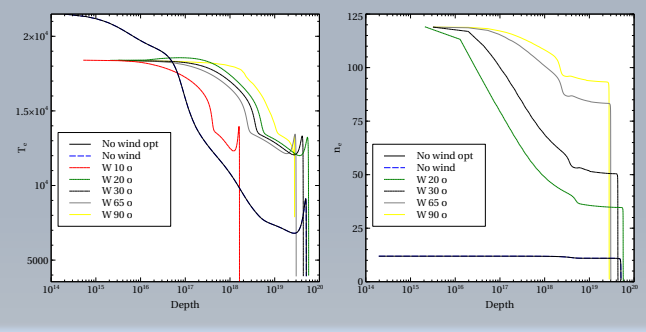
We obtained spectral data from the ionized bubble located in IC-2574. The observations were performed with a scanning Fabry-Perot Interferometer and long slit spectrograph at 6-m SAO RAS telescope. From observations we got that the nebula is expanding with V=65 km/s





Models

The first approach of project MEXICO was to find how the *Cloudy* parameters, 'Turbulence' and 'Wind', affect the ionized medium. By varying these parameters we aimed to find some relation with the parameters altered and properties of the region. The electron density (ne), electronic temperature (Te) and wind velocity are some examples of properties we investigated. With these properties examined we now hope to use them to accurately model the expansion of the bubbles.



Models Cont.

Best model for inner nebula:

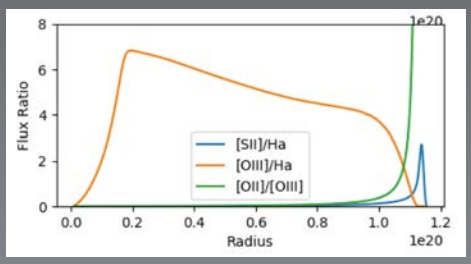
Q(H) = 51

Te = 49000 K

Ne = 30 cm^{-3}

F.F. = 0.3

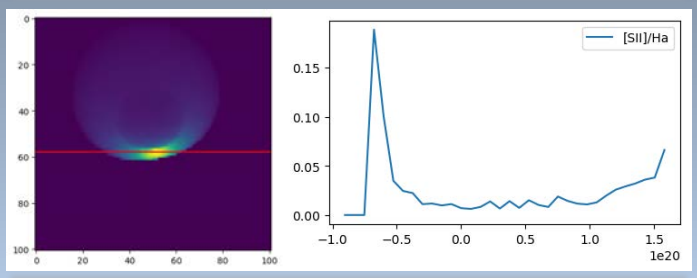
$Z = 0.2\ Z_o$



Results

After running simulations we see how turbulence and wind affect the penetration of the ionized photons. Overall, the wind and turbulence provided additional penetration but affected line ratios very little.

As for the 3D model, we have modeled the bubble and it is displayed in the figure below. This shows an Hα image on the left and the SII/Hα ratios as a function of position along the slit on the right.



Future

While we have successfully 3D modeled an off-center ionized bubble there is still a lot of work to be done. The current model is not physically accurate yet and will need additional modifications to improve the results.

We plan to adjust our observed line ratios to account for the slit used in spectroscopy. Also, we will consider the density distribution input used with the model to resemble a more appropriate scenario. Finally, the ionizing source at the center of this bubble is still under consideration as in what parameters to use.