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Supervisor's report on PhD Thesis submitted by Vojtěch Sidorin

Thesis title:

Shell-like structures in the ISM: Observation versus simulations

Vojtěch Sidorin completed his PhD Thesis as a part of his doctoral studies of the program F1: Theoretical Physics, Astronomy and Astrophysics, which is a joint program of the Charles University (Faculty of Mathematics and Physics) and of the Astronomical Institute of the Czech Academy of Sciences. The Thesis was submitted for defense in October 2016. It discusses the observed structures in the interstellar medium (ISM) and compares these structures to models of expanding shells.

Shell-like structures are found in the observations of the neutral hydrogen (HI) in the ISM. They are believed to result from the deposition of mass and energy into the ISM by stars. Also other sources of energy are discussed: gamma-ray bursts, collisions of high-velocity clouds with the HI discs of spiral galaxies, or the interstellar turbulence that may be the cause of shell formation. They influence the evolution of the ISM, since they are places where is the star formation triggered.

The thesis provides the review of our current knowledge on the ISM, interstellar turbulence, and shell-like structures. Later it focuses into the GLIMPSE bubble N107, which is a dusty shell-like structure found in the Milky Way. Its atomic, molecular, and radio-continuum components are compared, providing its distance (3.6 kpc), size (radius of 12 pc), and expansion velocity (8 km/s). As a part of the thesis, which was published in the international journal *Astronomy and Astrophysics*, 49 associated molecular clumps were identified. Using numerical simulations of expanding thin shell, Vojtěch Sidorin estimated the energy, position and density of the parent cloud where N107 was formed about 1 to 2 Myrs ago.

The Milky Way's bubble N107 is analyzed using different sources of data on HI distribution from Arecibo radio-telescope, Karl G. Jansky Very Large Array and Westerbork Synthesis Radio Telescope, on distribution of dust and molecules from Galactic Legacy Infrared Mid-Plane Survey by satellite SPITZER and United Kingdom Infrared Telescope deep sky survey. The Thesis describes the code QUICKCLUMP, which is a fast automated tool that identifies clumps in three-dimensional data. QUICKCLUMP is an improved version of previously published clump-finding codes.

I appreciate Vojtěch Sidorin's systematic approach to different data sources, some of these data were not published before. He adopted the code using the thin shell approximation, discussed the structure of the interstellar medium at the place of N107, and estimated its exciting energy and its age. Another contribution is the code QUICKCLUMP able to identify clumps in big 3D data files. I appreciate that the thesis was completed in the situation when Vojtěch Sidorin works outside of scientific institutions.

The thesis consisting of 3 Chapters plus Appendices is well written with a minimum misprints and excellent graphical outline. The extent 172 pages fulfills completely the usual standards.

I conclude that the Thesis brings new scientifically valuable results, which were partially published. I recommend this work to be admitted for the defense and advice that Vojtěch Sidorin be awarded PhD degree.

Yours sincerely

Jan Palouš

Prof. Jan Palouš, DSc.