In search of the New Shock Tracers in the Low Velocity Shocked Region of the Interstellar Medium

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Shock waves play an important role in controlling the physical and chemical evolution of the interstellar medium (ISM). In the ISM, shock waves are generated due to supernovae explosions, bipolar outflows etc. The detailed study of shock processing of cosmic dust particles remains overlooked. One of the objectives of this work is to identify new shock tracers in low velocity shocked regions of the ISM through laboratory experiments and theoretical calculations.

As a starting point, a pressure driven shock experiment was employed to study the chemical transformation of C_{60} fullerene in the millisecond time scale over the 5000- 7000 K temperature range. A UV-Vis spectrometer and a monochromator was coupled to the shock tube to study the in-situ decomposition of the shock exposed C_{60}. A strong signal corresponding to the C_2 emission with a broad underline continuum was observed. This broad continuum is likely due to the combined effect of the black-body emission of small carbon clusters and their recurrent fluorescence. The emission spectrum of the C_2 radical was simulated using the Exocross package[1,2] and was further corrected by considering self-absorption effects[3]. We also estimated the concentration of C_2 radicals in the experiment. Molecular dynamics simulations were performed under canonical and microcanonical approximations to investigate the temporal evolution of C_{60}. The results of this work will be used to test some aspects of astrophysical scenarios for the evolution of carbonaceous compounds in the ISM.

Acknowledgements

The research leading to the shock processing of the interstellar dust analogues is funded by CEFIPRA project 6005-N, PNPS and PCMI.

References

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