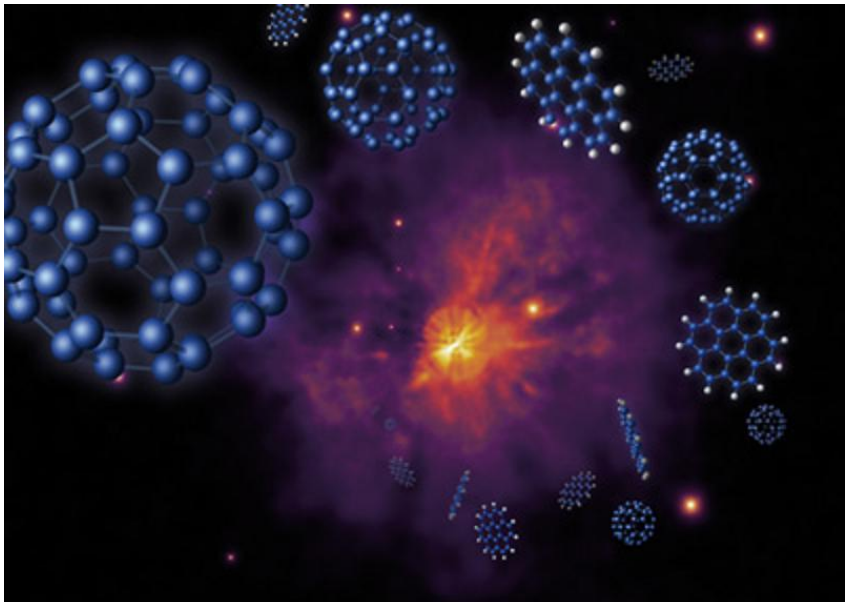
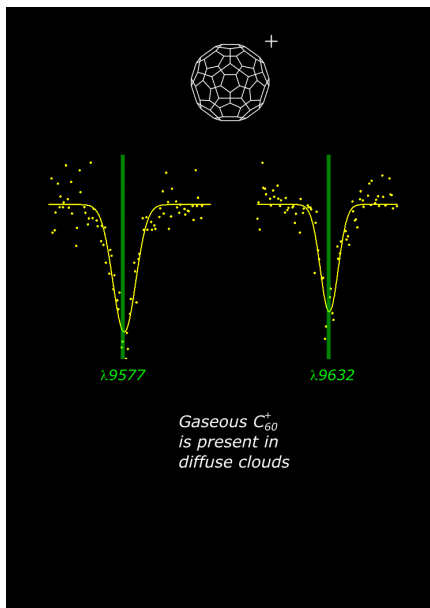
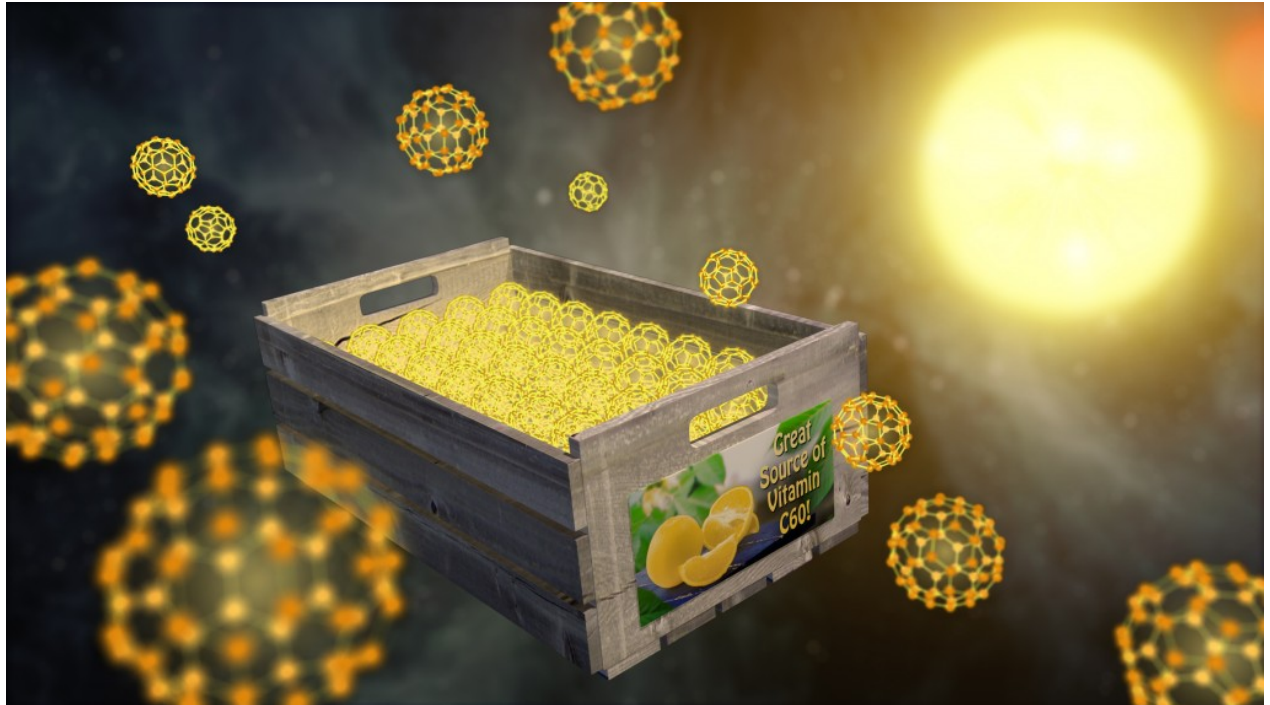
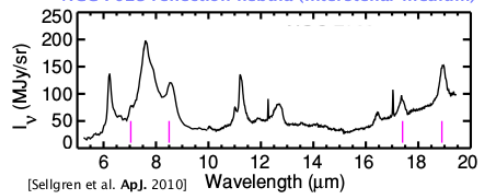


# $C_{60}$ from the Outer Space

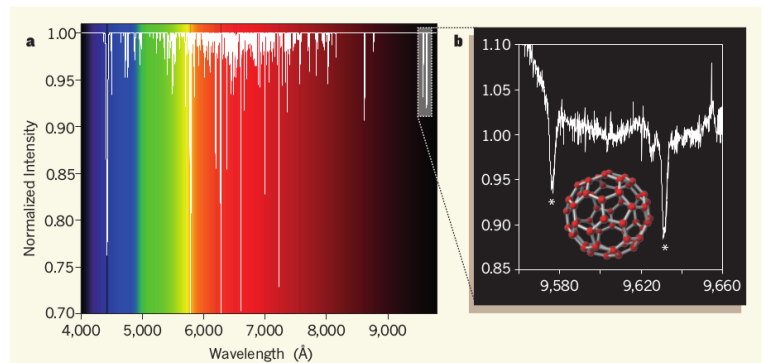
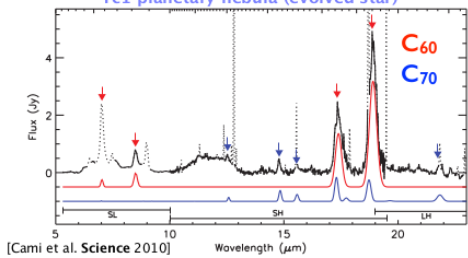
*Juan Francisco González Hernández*



NGC 7023 reflection nebula (interstellar medium)



Tc1 planetary nebula (evolved star)



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## 1 Fullerenes: the cosmic soccer balls

If you like soccer, you should love Chemistry and Astrochemistry as well. *Interstellar and extragalactic news*: Carbonaceous molecules known as **fullerenes**, e.g. the sexy buckyball (my “buckyball”, your soccer ball<sup>1</sup> !) or  $C_{60}$  (*buckminsterfullerene*) have been found in Outer Space [1, 2].

## 2 Diffuse interstellar cages

During the last 40 years the presence of emission bands (the strongest of which are found at 3.3, 6.2, 7.7, 8.6, 11.2 and 12.7  $\mu m$ ) in the mid-IR spectrum of our Galaxy was observed. Furthermore, the origin of the Diffuse Interstellar Bands (DIB) main absorption lines was a mystery, until now. Lab and measurements from Spitzer Space telescope have identified and matched the fingerprint of this molecule, its *spectrum* (see our *single* multimage cover sheet).

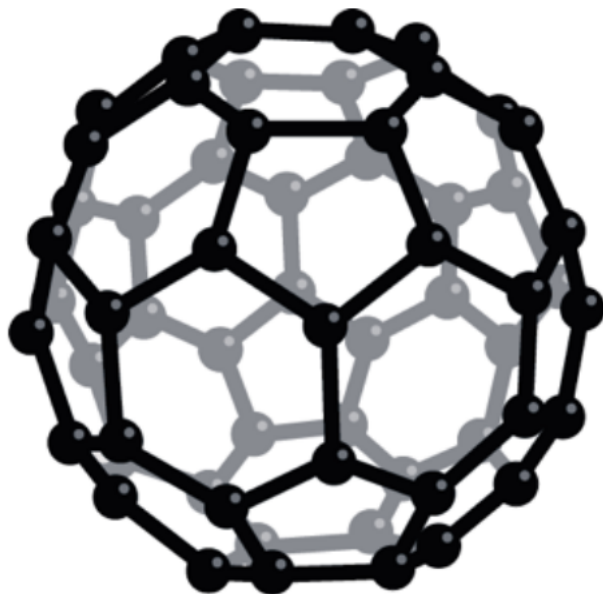
## 3 Spaceballs: Beyond

These spaceballs, identified by spectroscopy and now found in the circumstellar and interstellar medium or alien galaxies, solve some questions but rise new puzzles. How are they formed? What is their role as precursors of organic compounds and life? Are there other fullerene-like compounds in Outer Space?

*The Adventure of Astrochemistry is just beginning...*

## References

- [1] Berné, O., Montillaud, J., Mulas, G., & Joblin, C. 2015, *Proceedings of the Annual meeting of the French Society of Astronomy and Astrophysics*, 65. *30 years of cosmic fullerenes*, arXiv <http://arxiv.org/abs/1510.01642>
- [2] *Fullerene solves an interstellar puzzle*, Nature, vol. 523, 2016, p. 296-297.



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<sup>1</sup>*Buckyballs: Cosmic Soccer Balls*, available at <https://www.youtube.com/watch?v=LzmFk4EdBok>