fullerenes, more popularly known as “buckyballs”, are cage-like carbon molecules that have gained much attention for use as MRI contrast agents and other biomedical diagnostics, renewable energy, and materials.

Ionized fullerenes have been unambiguously identified to exist in large quantities in interstellar space and should uncover other astrophysical mysteries.

Figure 2. Positively charged buckyballs\(^3\), \(C_{60}^+\), (top) have recently been identified as the carrier of two diffuse interstellar bands (bottom), which are found throughout our galaxy in interstellar space. Therefore, new laboratory investigations of cosmic carbon should uncover other astrophysical mysteries.

Fullerene Polycyclic Aromatic Hydrocarbon

Carbon grain or ‘stardust’

Micrometer-sized carbon structure

Fullerene-based dyad

May be key ‘building blocks’ for stardust formation

Also of interest for use in material science (e.g., photovoltaics)

CONCLUSIONS

- A pulsed laser cluster source coupled to a high-resolution FT-ICR mass spectrometer is used to investigate cosmic carbon in the laboratory that are increasingly relevant in astrophysical research.
- These results should provide insight into the origin of stardust and fundamental carbon molecules that exist in interstellar and circumstellar environments.

REFERENCES


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IMPLICATION TO STARDUST

Figure 6. Molecular clusters formed from the high-energy reaction of a more complex chemical system containing \(C_{60}\), \(C_{70}\), and \(C_{22}H_{12}\). Both forms of carbon cage undergo addition reactions, although \(C_{70}\) appears to be more reactive than \(C_{60}\).