Metallicity and alpha-Element Abundance Gradients along the Sagittarius Stream as Seen by APOGEE

Por: Hayes, CR (Hayes, Christian R.)[1]; Majewski, SR (Majewski, Steven R.)[1]; Hasselquist, S (Hasselquist, Sten)[2]; Anguiano, B (Anguiano, Borja)[1]; Shetrone, M (Shetrone, Matthew)[3]; Law, DR (Law, David R.)[4]; Schiavon, RP (Schiavon, Ricardo P.)[5]; Cunha, K (Cunha, Katia)[6,7]; Smith, VV (Smith, Verne V.)[8]; Beaton, RL (Beaton, Rachael L.)[9,10] ...Más

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Abstract

Using 3D positions and kinematics of stars relative to the Sagittarius (Sgr) orbital plane and angular momentum, we identify 166 Sgr stream members observed by the Apache Point Observatory Galactic Evolution Experiment (APOGEE) that also have Gaia DR2 astrometry. This sample of 63/103 stars in the Sgr trailing/leading arm is combined with an APOGEE sample of 710 members of the Sgr dwarf spheroidal core (385 of them newly presented here) to establish differences of 0.6 dex in median metallicity and 0.1 dex in [alpha/Fe] between our Sgr core and dynamically older stream samples. Mild chemical gradients are found internally along each arm, but these steepen when anchored by core stars. With a model of Sgr tidal disruption providing estimated dynamical ages (i.e., stripping times) for each stream star, we find a mean metallicity gradient of 0.12 0.03 dex Gyr(-1) for stars stripped from Sgr over time. For the first time, an [alpha/Fe] gradient is also measured within the stream, at 0.02 0.01 dex Gyr(-1) using magnesium abundances and at 0.04 0.01 dex Gyr(-1) using silicon, which imply that the Sgr progenitor had significant radial abundance gradients. We discuss the magnitude of those inferred gradients and their implication for the nature of the Sgr progenitor within the context of the current family of Milky Way satellite galaxies, and we suggest that more sophisticated Sgr models are needed to properly interpret the growing chemodynamical detail we have on the Sgr system.

Palabras clave

Palabras clave de autor: Sagittarius dwarf spheroidal galaxy; Milky Way stellar halo; Chemical abundances; Galaxy evolution; Tidal tails; Galaxy chemical evolution; Galaxy abundances; Stellar kinematics; Stellar abundances; Dwarf galaxies

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Información del autor

Dirección para petición de copias: Hayes, CR (autor para petición de copias)

Univ Virginia, Dept Astron, Charlottesville, VA 22904 USA.

Direcciones:

[1] Univ Virginia, Dept Astron, Charlottesville, VA 22904 USA

[2] Univ Utah, Dept Phys & Astron, 115 S 1400 E, Salt Lake City, UT 84112 USA

[3] Univ Texas Austin, McDonald Observ, Austin, TX 79734 USA

[4] Space Telescope Sci Inst, 3700 San Martin Dr, Baltimore, MD 21218 USA

[5] Liverpool John Moores Univ, Astrophys Res Inst, 146 Brownlow Hill, Liverpool L3 5RF, Merseyside, England

[6] Observ Nacl, 77 Rua Gen Jose Cristino, BR-20921400 Rio De Janeiro, Brazil

[7] Univ Arizona, Steward Observ, 933 North Cherry Ave, Tucson, AZ 85721 USA

[8] Natl Opt Astron Observ, 950 North Cherry Ave, Tucson, AZ 85719 USA

[9] Princeton Univ, Dept Astrophys Sci, 4 Ivy Lane, Princeton, NJ 08544 USA

[10] Observ Carnegie Inst Sci, 813 Santa Barbara St, Pasadena, CA 91101 USA

[11] Flatiron Inst, Ctr Computat Astrophys, 162 Fifth Ave, New York, NY 10010 USA

[12] Inst Astrofis Canarias, E-38205 Tenerife, Spain

[13] Univ La Laguna, Dept Astrofis, E-38206 Tenerife, Spain

[14] Apache Point Observ, POB 59, Sunspot, NM 88349 USA

[15] New Mexico State Univ, POB 59, Sunspot, NM 88349 USA

[16] Moscow MV Lomonosov State Univ, Sternberg Astron Inst, Moscow, Russia

[17] Texas Christian Univ, Dept Phys & Astron, Ft Worth, TX 76129 USA

[18] Univ Atacama, Inst Astron & Ciencias Planetarias, Copayapu 485, Copiapo, Chile

[19] Inst Milenio Astrofis, Av Vicuna Mackenna 4860, Santiago, Chile

[20] Millennium Inst Astrophys, Av Vicuna Mackenna 4860, Santiago 7820436, Chile

[21] Eotvos Lorand Univ, Gothard Astrophys Observ, Szent Imre H St 112, H-9700 Szombathely, Hungary

[22] Hungarian Acad Sci, Budapest, Hungary

[23] MTA ELTE Exoplanet Res Grp, Szent Imre H St 112, H-9700 Szombathely, Hungary

[24] Univ Catolica Norte, Inst Astron, Av Angamos 0610, Antofagasta, Chile

[25] Univ Chile, Av Libertador Bernardo OHiggins 1058, Santiago, Chile

[26] Montana State Univ, Dept Phys, POB 173840, Bozeman, MT 59717 USA

[27] Univ La Serena, Fac Ciencias, Dept Fis, Cisternas 1200, La Serena, Chile

[28] Univ Washington, Dept Astron, Box 351580, Seattle, WA 98195 USA

[29] Univ Colorado, Ctr Astrophys & Space Astron, Dept Astrophys & Planetary Sci, 389 UCB, Boulder, CO 80309 USA

Direcciones de correo electrónico:crh7gs@virginia.edu

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