Dylan C. Hickson

Colorado School of Mines
Golden, CO, United States

Curriculum Vitae

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RESEARCH INTERESTS

I study the near-surface properties of small bodies, moons, and planets using a combination of Earth-based and spacecraft remote sensing and geophysical methods, with a focus on radar. I strive to improve geologic interpretation of remote sensing and radar techniques in order to understand the compositions, structures, and evolutions of rocky and icy bodies in the solar system.

EDUCATION

Ph.D., Earth & Space Science 2014 - 2019
York University Toronto, Canada

- Supervisor: Dr. Michael G. Daly
- Thesis: Characterizing the Dielectric Properties of Geologic and Asteroid Regolith Analogue Material for Improved Planetary Radar Interpretation

B.Sc., Honours in Earth and Environmental Science 2009 - 2014
B.Sc., Physical Science 2009 - 2014
McMaster University Hamilton, Canada

- Supervisor: Dr. Joseph Boyce
- Thesis: 3-D Ground Penetrating Radar (GPR) survey of a White Pine (Pinus Strobus) root system: comparison of grid-based versus radial survey methods
- Research Internship with the Environmental and Archaeological Geophysics Laboratory

ACADEMIC APPOINTMENTS

Research Associate 2021 - present
Department of Geophysics, Colorado School of Mines Golden, USA

Preeminent Postdoctoral Scholar 2019 - 2021
Arecibo Observatory, University of Central Florida Arecibo, Puerto Rico

Graduate Research Assistant 2014 - 2019
Centre for Research in Earth and Space Science, York University Toronto, Canada

PROFESSIONAL EXPERIENCE

Agricultural Geomatics Assistant 2013 - 2014
Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) Guelph, Canada

AWARDED GRANTS

PI, "The Enigmatic Surface of Bennu: Using OSIRIS-REx Data to Calibrate Ground-based Radar Observations of Near-Earth Asteroids", NASA New Frontiers Data Analysis Program (NFDAP), $461K — 2021 - 2024

Collaborator, "Polarimetry as a tool for physical characterization of potentially hazardous NEOs", NASA Yearly Opportunities in Research for Planetary Defence (YORPD) — 2022 - 2025

INVITED TALKS

3D Imaging of the Martian Polar Ice Caps: A glimpse into an ancient climate — Oct. 2021
Arecibo Observatory STAR Academy — Virtual Event

Revealing NEA Surfaces Using Radar Polarimetry from the Arecibo Observatory — Jan. 2021
Small Bodies Assessment Group — Virtual Meeting

The Latest in Space Exploration: OSIRIS-REx — Nov. 2020
Robinson School — Virtual Event

Supporting Space Missions in the Laboratory — Oct. 2020
Arecibo Observatory STAR Academy — Virtual Event

Planetary Science at the Arecibo Observatory — Nov. 2019
Arecibo Observatory STAR Academy — Arecibo, Puerto Rico

CONTRIBUTED TALKS

Radar as a tool to study the Solar System — Mar. 2021
UCF CLASS Graduate Seminar — Virtual Event

Introduction to Planetary Radar — Oct. 2020
Arecibo Observatory Observer Training Workshop — Virtual Event

Introduction to Planetary Radar Astronomy — Jun. 2020
Professional Development Week for AO REU Students — Virtual Event

Planetary Radar Polarimetry at Arecibo Observatory — Mar. 2020
UCF FSI Seminar — Orlando, USA

Radar Observing: Planetary Radar Astronomy — Aug 2019
GBO-AO Single Dish Training Workshop — Green Bank, USA

Interpreting Planetary Radar with Complex Permittivity Measurements for the Study of Asteroids — Nov. 2017
ESS Colloquium, York University — Toronto, Canada

Radar observations and experimental validation constraining regolith properties of planetary bodies — Jan. 2017
ESS Colloquium, York University — Toronto, Canada

Complex Permittivity Measurements of Planetary Analogue Mixtures in Vacuum — Jun. 2015
NSERC CREATE Annual Meeting — Kingston, Canada

Improved Radar Interpretations: Applications to Asteroids — Jun. 2014
NSERC CREATE Annual Meeting — Toronto, Canada

PUBLIC OUTREACH

Featured in the documentary film "The Biggest Dream" — Feb. 2022
Arecibo, Puerto Rico

"Make your own impact crater!" - Hands-on activity — Nov. 2021
Shelton Elementary STEM Fair — Golden, CO

Featured on *Spacepod* podcast — Feb. 2021
Virtual

Asteroid Day - Team Radar Panel — Jun. 2020
Arecibo Observatory Asteroid Day Event — Virtual

Talk: *Rocks in Space* — Jun. 2019
Arecibo Observatory Asteroid Day Event — Arecibo, Puerto Rico

Talk: *Using Radar to Probe the Inner Solar System* — Jun. 2017
Solar System Social — Toronto, Canada

TEACHING & MENTORING

Teaching Assistant — 2014 - 2019
Department of Earth and Space Science & Engineering, York University — Toronto, Canada

Teaching Assistant — 2014 - 2019
Department of Natural Science, York University — Toronto, Canada

Undergraduate Advising

- Amanda Camarata, MURF research assistant, Colorado School of Mines — 2021 - present
- Matthew Russell, MURF research assistant, Colorado School of Mines — 2021 - present
- César F. Quiñones Martínez, Planetary Radar Intern, Arecibo Observatory — 2020 - 2021
- Yoliett Velez Rivera, Planetary Radar Intern, Arecibo Observatory — 2019 - 2020

AWARDS & HONOURS

International Astronomical Union
Asteroid (33896) 2000 KL_{40} named (33896) Hickson 2021

University of Central Florida
Preeminent Postdoctoral Program Scholar 2019 - 2021

York University

- Ontario Graduate Scholarship 2017 - 2019
- Earth and Space Science REC Conference Presentation 2nd prize 2018
- Mensa Canada Scholarship 2017
- Carswell Scholar 2016
- York Graduate Scholarship 2016
- NSERC CREATE Graduate Student Fellow 2014

McMaster University
Dean's Honour List 2013

PROFESSIONAL & INSTITUTIONAL SERVICE

Journal Reviewer
Icarus

Panel Reviewer & Executive Secretary
NASA ROSES, NSF AAG

Session Chair
LPSC

Arecibo Observatory
Seminar Coordinator 2019-2021

McMaster University
Science Society Representative 2011-2013

PEER-REVIEWED JOURNAL PUBLICATIONS

12. Zambrano-Marin, L.F., Howell, E.S., Taylor, P.A., Marshall, S.E., Devogèle, M., Virkki, A.K., **Hickson, D.C.**, Rivera-Valentín, E.G., Venditti, F. and Giorgini, J. (2021) Radar and optical characterization of near-Earth asteroid 2019 OK. *The Planetary Science Journal*, submitted.

11. Virkki, A.K., Marshall, S.E., Venditti, F.C.F., Zambrano-Marín, L.F., **Hickson, D.C.**, et al (2021) Arecibo Planetary Radar Observations of Near-Earth Asteroids: 2017 December - 2019 December. *The Planetary Science Journal*, in-review.

10. Reddy, V., et. al including **Hickson, D.C.** (2021) Near-Earth Asteroid (66391) Moshup (1999 KW4) Observing Campaign: Results from a Global Planetary Defense Characterization Exercise. *Icarus*, in-press.

9. **Hickson, D.C.**, Virkki, A.K., Perillat, P., Nolan, M.C. and Bhiravarasu, S.S. (2021) Polarimetric Decomposition of Near-Earth Asteroids Using Arecibo Radar Observations. *The Planetary Science Journal*, 2(30), 1-15.

8. Lalla, E.A., Konstantinidis, M., Czakler, C., Garnitschnig, S., **Hickson, D.**, Such, P., Losiak, A., Ercolli, M., Frigeri, A., Hoffman, A., Lucic, T., Seikora, N., Suchantke, I., Gruber, S. and Groemer, G. (2020) Remote science activities during the AMADEE-18 Mars Analog Mission: Preparation and execution during a simulated planetary surface mission. *The Journal of Space Safety Engineering*, 8(1), 75-85.

7. Lalla, E., Cote, K., **Hickson, D.**, Garnitschnig, S., Konstantinidis, M., Such, P., Czakler, C., Schroder, C., Frigeri, A., Ercoli, M., Losiak, A., Gruber, S. and Groemer, G. (2020) Laboratory analysis of returned samples from the AMADEE-18 Mars analog mission. *Astrobiology*, 20(11), 1303-1320.

6. **Hickson, D.C.**, Boivin, A.L., Tsai, C.-A., Daly, M.G. and Ghent, R.R. (2020) Modeling the Dielectric Properties of Minerals from Crystals to Bulk Powders for Improved Interpretation of Asteroid Radar Observations. *Journal of Geophysical Research: Planets*, 125(7), 1-22.

5. Tsai, C., Ghent, R., Boivin, A. and **Hickson, D.** (2019) Discrimination of Dispersive Materials From Radar Signals Using Q^*. *Ground Penetrating Radar*, 2(1), 26-50.

4. Osinski, G.R., et. al including **Hickson, D.** (2019) The CanMars Mars Sample Return analogue mission. *Planetary and Space Science*, 166, 110-130.

3. **Hickson, D.**, Boivin, A., Daly, M.G., Ghent R., Nolan, M.C., Tait, K., Cunje, A. and Tsai, C-A. (2018) Near surface bulk density estimates of NEAs from radar observations and permittivity measurements of powdered geologic material. *Icarus*, 306, 16-24.

2. Boivin, A., **Hickson, D.**, Cunje, A., Tsai, C-A., Ghent, R.R. and Daly, M. (2018) Broadband Measurements of the Complex Permittivity of Planetary Regolith Analog Materials. *Journal of Geophyisical Research: Planets*, 123(12), 3088-3104.

1. **Hickson, D.**, Sotodeh, S., Daly, M., Ghent, R. and Nolan, M.C. (2017) Improvements on effective permittivity measurements of powdered alumina: Implications for bulk permittivity properties of asteroid regoliths. *Advances in Space Research*, 59, 472-482.

NON-PEER-REVIEWED NOTES, WHITE PAPERS, AND REPORTS

9. Anish Roshi, D., et al including **Hickson, D.** (2021) The Future Of The Arecibo Observatory: The Next Generation Arecibo Telescope. Submitted as a white paper to the US National Science Foundation.

8. Rivera-Valentín, E.G. et al. including **Hickson, D.** (2020) The importance of ground-based radar observations for planetary exploration. Submitted as a white paper to the US National Academies of Science, Engineering, and Medicine (NASEM) *Planetary Science and Astrobiology Decadal Survey (2023-2032).*

7. Virkki, A.K., et al. including **Hickson, D.C.** (2020) Near-Earth object characterization using ground-based radar systems. Submitted as a white paper to the US NASEM *Planetary Science and Astrobiology Decadal Survey (2023-2032).*

6. Haynes, M., et al. including **Hickson, D.** (2020) Asteroids Inside Out: Radar Tomography. Submitted as a white paper to the US NASEM *Planetary Science and Astrobiology Decadal Survey (2023-2032)*.

5. Nolan, M.C., et al. including **Hickson, D.C.** (2020) Near-Earth Objects. Submitted as a white paper to the US NASEM *Planetary Science and Astrobiology Decadal Survey (2023-2032)*.

4. Mainzer, A., et al. including **Hickson, D.C.** (2020) The Future of Planetary Defense in the Era of Advanced Surveys. Submitted as a white paper to the US NASEM *Planetary Science and Astrobiology Decadal Survey (2023-2032)*.

3. Giorgini, J.D., Farnocchia, D., **Hickson, D.C.**, Marshall, S.E., Zambrano-Marin, L.F., Virkki, A.K. and Taylor, P.A. (2020) (264357) 2000 AZ93. CBET 4787.

2. Anish Roshi, D., et al. including **Hickson, D.** (2019) Astro2020 Activities and Projects White Paper: Arecibo Observatory in the Next Decade. Submitted as an Activities and Projects white paper to the US NASEM *Decadal Survey on Astronomy and Astrophysics 2020 (Astro2020)*.

1. Carter, T., Contreras, D., Doyle, S., **Hickson, D.**, Mihailovic, D., Morgan, J., and Moutsiou, T. (2014) Stelida Naxos Archaeological Project - 2014 Report. Submitted to the Canadian Institute in Greece.

CONFERENCE ABSTRACTS

36. Monchinski, C. et al including **Hickson, D.** (2021) Characterization of Asteroid 52768 (1998 OR2). 53^{rd} *Meeting of the American Astronomical Society (AAS) Division for Planetary Sciences (DPS)*, virtual, 3-8 Oct.

35. Zambrano Marin, L. et al. including **Hickson, D.** (2021) 2020 BX12: The Last Binary Asteroid Discovered by Arecibo Observatory. 53^{rd} *Meeting of the AAS DPS*, virtual, 3-8 Oct.

34. Venditti, F.C.F., Virkki, A.K., Marshall, S.E., Devogèle, M., Zambrano-Marin, L.F., **Hickson, D.** and McGilvray, A. (2021) The Past, Present, and Future of the Arecibo Planetary Radar (abstract). 7^{th} *Planetary Defence Conference (PDC)*, virtual/hybrid conference, 26-30 Apr.

33. Taylor, P.A., Wright, E.L., Masiero, J.R., Virkki, A.K., Venditti, F.C.F., Marshall, S.E., **Hickson, D.C.**, Zambrano-Marin, L.F., Becker, T.M., Nolan, M.C. and Giorgini, J.D. (2021) Characterization of Near-Earth Asteroid 153814 (2001 WN5) and Prospects for the 2028 Close Encounter with Earth (abstract). 7^{th} *PDC*, virtual/hybrid conference, 26-30 Apr.

32. Zambrano-Marin, L.F., Howell, E.S., Devogèle, M., Marshall, S.E., **Hickson, D.**, Virkki, A.K., Venditti, F.C.F., Rivera-Valentín, E.G., Taylor, P.A., Negron, V., Cabrera, I. and Marrero, J. (2021) Rapid Response Radar: Arecibo and 2019 OK (abstract 147). 7^{th} *PDC*, virtual/hybrid conference, 26-30 Apr.

31. **Hickson, D.C.**, Virkki, A.K. and Rivera-Valentín, E.G. (2021) Polarimetric Analyses of Archival Arecibo near-Earth Asteroid Radar Observations (abstract 2593). 52^{nd} *Lunar and Planetary Science Conference (LPSC)*, virtual conference, 15-19 Mar.

30. Zambrano-Marin, L.F., Howell, E.S., Devogèle, M., Marshall, S.E., **Hickson, D.**, Virkki, A.K., Venditti, F.C.F., Rivera-Valentín, E.G., Taylor, P.A., Negron, V., Cabrera, I. and Marrero, J. (2021) Radar Observations of Near-Earth Asteroid 2019 OK (abstract 2451). 52^{nd} *LPSC*, virtual conference, 15-19 Mar.

29. **Hickson, D.C.**, Virkki, A., Perillat, P., Nolan, M.C., and Bhiravarasu, S.S. (2020) Polarimetric Decomposition of Arecibo Radar Observations of Near-Earth Asteroids (poster [P016-0013]). *2020 American Geophysical Union (AGU) Fall Meeting*, virtual, 1-17 Dec.

28. Virkki, A.K., Venditti, F.C.F., **Hickson, D.C.**, Perillat, P., Marshall, S.E., Taylor, P.A., and Herique, A. (2020) Bistatic Arecibo Planetary Radar Observations of 99942 Apophis. *Apophis T-9 Years Workshop*, virtual, 4-6 Nov.

27. Nolan, M.C. et al. including **Hickson, D.** (2020) Multiwavelength RADAR Observations of Apophis. *Apophis T-9 Years Workshop*, virtual, 4-6 Nov.

26. Herique, A. et al. including **Hickson, D.** (2020) Direct observation of 99942 Apophis with radar. *Apophis T-9 Years Workshop*, virtual, 4-6 Nov.

25. Venditti, F., Marshall, S., Virkki, A., Taylor, P., **Hickson, D.** and Giorgini, J. (2020) Arecibo Observatory radar observation of potentially hazardous asteroid 2020 NK1 (talk). 52^{nd} *Meeting of the AAS DPS*, virtual, 26-30 Oct.

24. Virkki, A., Venditti, F., Marshall, S.E., Devogèle, M., **Hickson, D.C.**, Zambrano Marin, L.F., McGilvray, A., Taylor, P. and Rivera-Valentín, E. (2020) Science Highlights of near-Earth asteroid radar observations at Arecibo Observatory (talk). 52^{nd} *Meeting of the AAS DPS*, virtual, 26-30 Oct.

23. Devogèle, M., et al. including **Hickson, D.** (2020) Heterogeneous surface of 1998 OR2 (talk). 52^{nd} *Meeting of the AAS DPS*, virtual, 26-30 Oct.

22. Prabhu Desai, S., Margot, J., Taylor, P., Venditti, F., Marshall, S., Virkki, A., **Hickson, D.** and Fernanda, L. (2020) Evolution of the Binary Asteroid 66391 Moshup-Squannit (1999 KW4) (poster). 51^{st} *Annual Meeting of the Division on Dynamical Astronomy*, virtual, 3-7 Aug.

21. **Hickson, D.** and Virkki, A. (2020) Modeling the effect of iron oxides on asteroid radar albedos (talk). *Europlanet Science Congress (EPSC) 2020*, virtual, 21 Sep - 9 Oct.

20. Zambrano-Marin, L., Virkki, A., Marshall, S., Venditti, F., **Hickson, D.**, McGilvray, A., Devogèle, M., Taylor, P. and Rivera-Valentín, E. (2020) Arecibo Science Highlights of Observatory Planetary Radar Observations: 2019-2020 (talk). *EPSC 2020*, virtual, 21 Sep - 9 Oct.

19. **Hickson, D.C.**, Becker, T.M., Virkki, A.K., Venditti, F.C.F., Marshall, S.E., Zambrano-Marin, L.F. and McGilvray, A. (2020) Space Weathering Effects from UV to Radar Wavelengths (abstract [1704]). 51^{st} *Lunar and Planetary Science Conference (LPSC)*, conference cancelled due to COVID-19.

18. Venditti, F., Virkki, A., Marshall, S., **Hickson, D.**, Taylor, P. and Zambrano-Marin, L. (2020) Arecibo Observatory: a ground and space joint effort in support of small bodies exploration (talk). *Planets 2020*, Santiago, Chile, 2-6 Mar.

17. Venditti, F., Virkki, A., Marshall, S., **Hickson, D.C.**, Taylor, P.A. and Zambrano-Marin, L.F. (2019) Arecibo Observatory: Supporting Planetary Defense (poster [NH51C-0784]). *2019 AGU Fall Meeting*, San Francisco, USA, 9-13 Dec.

16. Boivin, A., Tsai, C-A., **Hickson, D.C.**, Ghent, R.R. and Daly, M.G. (2019) MCMC-Based Model Parameter Estimation from Measurements of the Complex Electromagnetic Characteristics of Planetary Regolith Analog Materials (poster [P31B-3436]) . *2019 AGU Fall Meeting*, San Francisco, USA, 9-13 Dec.

15. **Hickson, D.C.**, Boivin, A.L., Tsai, C., Daly, M.G. and Ghent, R.R. (2019) Quantifying Asteroid Regolith Porosity from Radar Data (poster [2480]). 50^{th} *LPSC*, The Woodlands, USA, 18-22 Mar.

14. **Hickson, D.C.**, Boivin, A., Daly, M.G., Ghent, R.R., Tsai, C. and Tait, K. (2018) Measurement-based Modeling of the Dielectric Permittivity of Particulate Geologic Material for Improved Radar Interpretation (poster [P51G-2964]). *2018 AGU Fall Meeting*, Washington DC, USA, 10-14 Dec.

13. Cunje, A.B., Ghent, R.R., Boivin, A., Tsai, C-A. and **Hickson, D.** (2018) Dielectric Properties of Martian Regolith Analogs and Smectite Clays (poster [1805]). 49^{th} *LPSC*, The Woodlands, USA, 19-23 Mar.

12. **Hickson, D.C.**, Boivin, A., Daly, M.G., Ghent, R.R. and Tait, K. (2018) Characterizing the Dielectric Behaviour of Asteroid Regolith Analogue Minerals for Planetary Radar Interpretation (poster). *Women in Planetary Science and Exploration (WPSE) 2018*, Toronto, Canada, 17-18 Feb.

11. **Hickson, D.**, Boivin, A., Daly, M.G., Ghent, R.R., Nolan, M.C., Tait, K., Cunje, A. and Tsai, C-A. (2017) Constraining Bulk Densities of Near-Earth Asteroid Surfaces from Radar Observations Using Laboratory Measurements of Permittivity (poster [P13B-2555]). *2017 AGU Fall Meeting*, New Orleans, USA, 11-15 Dec.

10. Boivin, A., **Hickson, D.**, Cunje, A., Tsai, C-A., Ghent, R.R. and Daly, M.G. (2017) Measurements in Vacuum of the Complex Permittivity of Planetary Regolith Analog Materials in Support of the OSIRIS-REx Mission (poster P13B-2556]). *2017 AGU Fall Meeting*, New Orleans, USA, 11-15 Dec.

9. Boivin, A., **Hickson, D.**, Cunje, A., Tsai, C-A., Ghent, R.R. and Daly, M.G. (2016) Measurements in Vacuum of the Effect of Ilmenite on the Complex Dielectric Permittivity of Planetary Regolith Analog Materials (poster [P51C-2148]). *2016 AGU Fall Meeting*, San Francisco, USA, 12-16 Dec.

8. **Hickson, D.**, Sotodeh, S., Daly, M. and Ghent, R. (2016) Boundary Conditions Modelling of Permittivity Measurements of Powders in Coaxial Airline (poster [2137]). 47^{th} *LPSC*, The Woodlands, USA, 21-25 Mar.

7. Zylberman, W., **Hickson, D.**, Haid, T. and Osinski, G.R. (2016) 2015 CanMars MSR Analogue Mission: The Key Role of LiDAR in Rover Navigation and Potential for Future Missions (poster [1041]). 47^{th} *LPSC*, The Woodlands, USA, 21-25 Mar.

6. Boivin, A., **Hickson, D.**, Cunje, A., Ghent, R. and Daly, M. (2016) Broadband Measurements of Dielectric Permittivity of Planetary Regolith Analogue Materials using a Coaxial Transmission Line in Vacuum (poster [2025]). 47^{th} *LPSC*, The Woodlands, USA, 21-25 Mar.

5. **Hickson, D.**, Daly, M., Ghent, R., Boivin, A., Cunje, A. and Tsai, C-A. (2015) Complex Permittivity Measurements of Powders (poster). 9^{th} *OSIRIS-REx Science Team Meeting*, John Hopkins Applied Physics Laboratory, Laurel, USA, 20-22 Oct.

4. Boivin, A., Tsai, C-A., **Hickson, D.**, Ghent, R. and Daly, M. (2015) Preliminary Broadband Measurements of Dielectric Permittivity of Planetary Regolith Analogue Materials Using a Coaxial Transmission Line (poster [2487]). 46^{th} *LPSC*, The Woodlands, USA, 16-20 Mar.

3. **Hickson, D.**, Nussli, E., Steckley, Z. and Sweeney, S. (2014) Agricultural Landscapes of the City of Ottawa: Mobile Mapping Groundtruth Results 2014 (poster). *Canadian Association of Geographers-Ontario Division Annual Meeting (CAGONT) 2014*, York University, Toronto, Canada, 24-25 Oct.

2. Nussli, E., Anwar, S., Gardner, S., **Hickson, D.**, Shaw, A., Steckley, Z., Vanthof, V. and Sweeney, S. (2014) Leamington Township's Agricultural Landscape Pre and Post the Heinz Company Tomato Supply Era: A Detailed Field-by-Field Comparison of the 2013 and 2014 Cropping Seasons (poster). *CAGONT 2014*, Toronto, Canada, 24-25 Oct.

1. Anwar, S., Goodfellow, S., Caldwell, J., Gardner, S., **Hickson, D.**, Smith, D., Steckley, Z. and Sweeney, S. (2014) The Northern Bruce Peninsula Agricultural Landscape: Multi-temporal Observations with Mobile Mapping Technology (poster). *CAGONT 2014*, Toronto, Canada, 24-25 Oct.