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Dynamics of the Oort cloud and formation of interstellar comets

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Citation

Torres Rodriguez, S. (2020, April 30). *Dynamics of the Oort cloud and formation of interstellar comets*. Retrieved from https://hdl.handle.net/1887/87515

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Author: Torres Rodriguez, S.
Title: Dynamics of the Oort cloud and formation of interstellar comets
Issue Date: 2020-04-30

List of publications

Refereed papers

1. *Dynamical evolution of exo-Oort clouds around the Sun's closest neighbour stars due to local stellar perturbations and the Galactic tidal field*, submitted to Astronomy & Astrophysics, in review, 2020.
   S. Torres, S. Portegies Zwart, and A. G. A. Brown.

2. *Dynamical evolution of the solar system debris disk in its birth cluster*, submitted to Astronomy & Astrophysics, recommend for publication, 2019b.
   S. Torres, M. X. Cai, D. Mukherjee, S. Portegies Zwart, and A. G. A. Brown.

3. *Galactic tide and Local Stellar Perturbation on the Oort Cloud: Creation of Interstellar Comets*, Astronomy & Astrophysics 629 - A139, 2019a.
   S. Torres, M. X. Cai, S. Portegies Zwart, and A. G. A. Brown.

4. *The Origin of Interstellar Asteroidal Objects Like 1I/2017 U1 'Oumuamua*, Monthly Notices of the Royal Astronomical Society (MNRAS) 479, L17-L22, 2018.
   S. Portegies Zwart, **S. Torres**[*], I. Pelupessy, J. Bédorf, and M. X. Cai.

Co-author

1. *Once upon a time in the Oort cloud*, submitted to *Science*, 2020.
   S. Portegies Zwart, **S. Torres**, A. G. A. Brown, and M. X. Cai.

2. *Evolution of the Outer Planets and Planetesimals due to Gas Drag in Transition Disks*, APS id. C9.006, 2014.
   S. Navarro, M. Reyes-Ruiz, H. Aveves, C. Chavez, **S. Torres**.

3. *Effect of a Gaseous Transition Disc on Planetesimal Driven Migration*, DPS #45, id.415.05, 2013.
   M. Reyes-Ruiz, H. Aceves, C. Chavez, **S. Torres**.

[*] Equal contribution as the first author.

4. *The Transneptunian Automated Occultation Survey (TAOS II)*, Asteroids, Comets, Meteors, No. 1667, id.6111, 2012.
   M. J. Lehner, S.-Y. Wang, P. Ho, T. Lee, Z.-W. Zhang, W.-L Yen, M. Reyes Ruiz, D. Hiriart, A. P. Granados, **S. Torres**, C. Alcock, A. Szentgyorgyi, J. C. Geary, T. Norton, G. Furesz.

Conference proceedings

1. *Dynamics of the Oort cloud in the Gaia era I: close encounters*, IAU-330 Gaia symposium, 2017.
   S. Torres, S. Portegies Zwart, and A. G. A. Brown.

2. *Dynamics and habitability in very low mass stars that belong to stellar clusters*, Astrobiology Science Conference, 2015.
   S. Torres & B. Pichardo.

3. *Dynamics of protoplanetary disk in stellar clusters: very low mass stars*, ADELA, 2015.
   S. Torres & B. Pichardo.

In preparation

1. *Dynamics of low mass stars in different Galactic environments*, in preparation, 2020.
   S. Torres.

2. *Debris disk survivability around very low mass stars*, to be submitted to MNRAS, 2020.
   S. Torres & B. Pichardo.

3. *Stellar cluster characterization using artificial intelligent methods to predict Gaia observables*, in preparation, 2020.
   J. Albert, **S. Torres**, and S. Portegies Zwart.

Curriculum Vitae

I was born in Mexico city approximately 32 years ago. When I was a child, I was curious about everything, and always asked myself how the things work?. In particular, I was fascinated with one story that my parents used to tell me: *The mystery of the three stars on the sky*, that mysteriously appeared only during Christmas. For so many years, I tried to find the answer to such an event but did not succeed (although I was very close). When finally I entered to the secondary school, I asked my physics teacher, and his answer was: "To disentangle such a mystery you have to become an Astronomer, but in order to do that you have to study first a bachelor degree in Physics, a master degree in Astrophysics and finally a PhD in Astrophysics", and then the journey who brought me here began.

In 2006 I enrolled in the National Autonomous University of Mexico (UNAM) to study Physics. The first years were tough, but quickly I adapted to the rhythm. In my second year, I went to the Institute of Astronomy to offer my services as a student. The result of that visit completely changed my life. I met Barbara Pichardo, who after a small interview offered me to supervise my bachelor thesis and more important her friendship. With Barbara's support, I participated in several international projects like APOGEE and TAOS-II. In 2012 I moved to Taipei as part of the scientific team of TAOS-II at the Academia Sinica Institute of Astronomy and Astrophysics (ASIAA). After a successful internship in Taiwan and as a part of the next step in the list to become an Astronomer. At the end of 2012, I won a scholarship from the Spanish government to enrol in the master in Astrophysics at Universidad Autónoma de Madrid - Universidad Complutense de Madrid where I worked closely with Eva Villaver.

In the fall of 2015, I was notified that I was awarded a fellowship from the Mexican National Council for Science and Technology (CONACYT) for PhD studies abroad. After several meetings with Anthony Brown and a lot of bureaucracy finally, in November 2015, I landed in Schiphol. Full of dreams and enthusiasm I started my PhD in Astrophysics (and the last step in my list) at Leiden Observatory under the supervision of Anthony Brown and Simon Portegies Zwart. During four years, I travelled the world, talked, collaborated and shared with wonderful people and scientists, and I explored the origin and evolution of the outer solar system.

In February 2020, I accepted a postdoctoral fellowship at the University of California, Los Angeles (UCLA) in USA. I will join Smadar Naoz's research group, and I will continue the journey that I started many years ago: discover the universe.

Acknowledgements

About four years ago, I came to the Netherlands to pursue my PhD. I never imagined that my life will completely be changed along these years. I met wonderful people and scientists whose support, advice and friendship helped me to achieve my goal. I will always be grateful to all of you that were with me in one way or another in my PhD journey. Especially, I would like to thank...

To the Mexican National Council for Science and Technology (CONACYT), whose support made my PhD at Leiden Observatory possible. To Leiden Observatory for the unconditional support. In particular, thank you Evelijn, Alexandra, Els, Marjan, Monica, Caroline, Erik Deul, Eric, for always smiling and helping me with all the bureaucracy, computers, and other issues that I faced during my PhD. You made my life at the observatory way more smooth. To Xander for all the support during and especially in the last part of my PhD, you encouraged me to push hard and finish. To all the members of CASTLE, AMUSE, and Gaia groups, for being part of my personal and scientific development, for all the discussions and nice conversions we had in our group meetings. In particular thank you, Lucie, Adrian, Init, Silvia, Fran, Martijn, Jeroen, Max, Eleonora, Tommaso, Stella, Fraser, Steven, Edwin, and Arjen. Thank you, Anthony and Simon, for your patience, advices, scientific discussions, ups and downs, and for pushing me to be a better scientist and finish my PhD.

¡Bárbara!, gracias por compartirme tu pasión por la vida, por los dinosaurios, por la astronomía y por la enseñanza. Me enseñaste a ser una mejor persona, un mejor amigo, un mejor astrónomo. Gracias a ti, a tu confianza y apoyo incondicional concluí mi licenciatura, maestría y ahora doctorado. Fuiste y siempre serás mi amiga, mi colaboradora, mi mentora y mi madre académica. Esta tesis te la dedico a ti.

To my friends in the observatory: Eleonora, Igone, Kim, Gaby, Marco, Luis, Tommaso, Clément, Christos, Alex, Andres, Alvaro, Jit, Josh, Valeriya, Mieke, Fran, Max, Tjarda, Noel, Carmen, Jeroen, Thomas Wijnen, Maria Cristina, Gabriela, Anna, Stella, Dilovan, Robin, Aayush, Oscar, Martijn (thank you for helping me with my Dutch summary), Cristina (thank you for all the lunches, I had a lot of fun talking with you about life), among many other nice people I met. My life in the observatory would not have been the same without you. Max, thank you for all the nice discussions about science and life, for being my best collaborator, and for all your help during these years. I enjoyed writing papers with you and I'm sure more will come. Fran, gracias por todo tu apoyo, risas, terapias, group meetings, almuerzos y por ser una office mate de lujo. Luis, compadre extrañare esas largas conversiones acerca de la vida, que chevere fue compartir el doctorado contigo. Eleonora, tu fuiste la primer persona a la que conocí, gracias por todos los buenos momentos que compartimos, por siempre sonreír y chismear conmigo, pero más importante gracias por tu amistad.

A la mini Latinoamérica en Holanda: Lina, Jorge, Kathy, Karinoa, Arlen, Javiera, Paula, Pedro, Pablo, Nico, Heather, Fran, Liz, Max, Andres, Yanett, Marta Irene, Cristina, Claudio (gracias maestro, por las clases de tenis), gracias a todos por hacerme sentir como en casa. Kathy y Javi, gracias por abrirme las puertas de su casa y por su amistad. Marta, Lina y Jorge, gracias por tantas risas, bailes, platicas, terapias, salidas al Lemmys y por compartir conmigo sus vidas en todos estos años, estoy seguro que nuestros caminos se volverán a cruzar. Noel y Susy no tengo como agradecer todo lo que hicieron por mi desde que llegue a Holanda. Gracias por todas esas cenas y fiestas mexicanas, por su apoyo incondicional, por su amistad, por hacerme sentir como en México, con ustedes siempre me sentí en casa. To my life friends: Alejandro (Mai), Andrea, Silvia, Sophy, Celine, John, Brisa, Paty, Sara, Ofelia, Mathieu, Zavala, Jorge, Iber, Nayeli, Engin, Alejandra, Mabel, Joaquin, Fer, Linn, Maja, Maria, Nikita, Shayen, Ana, Tomas, Thomas van der Toorn, Penny, Amruta, Valentina, Esperanza, Ning, Macla, Kaustubh, Vandana, Smriti, Ciccio, and Ali for all the good times and the ones that are about to come, thank you all! To all my teammates of the very successful and unsuccessful football club that we formed, we certainly had a lot of fun.

A mis queridos cascos, Ro, Chero y Sebas, sin ustedes mis últimos años en Leiden no hubieran sido lo mismo. Gracias compadres por todas las fiestas, consejos, macumbas, viajes, desvelos, kebabs, partidos de fut, cervezas, tequilas, pero sobre todo gracias por su amistad, estoy seguro nos volveremos a encontrar y rumbear juntos.

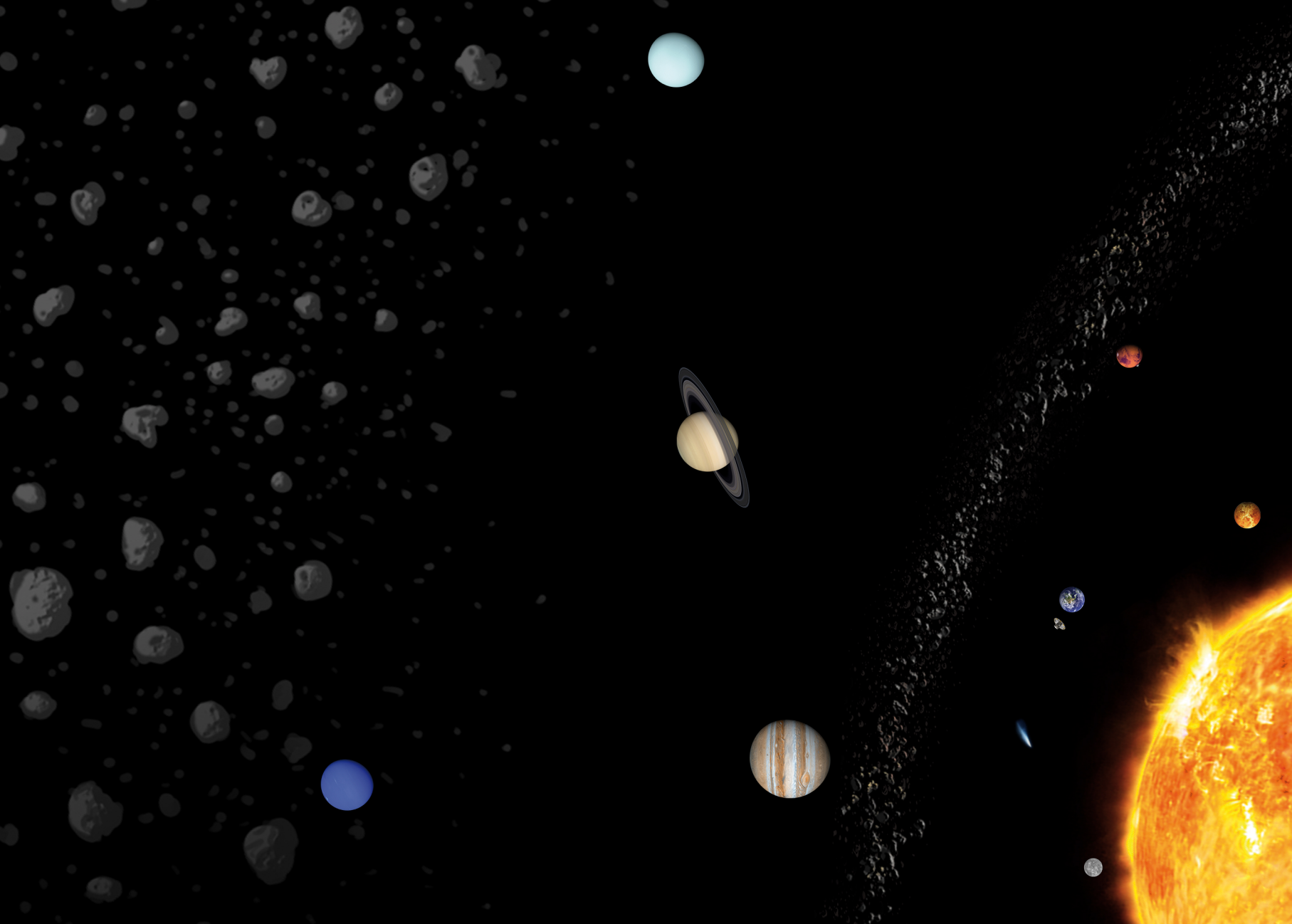
A mis papas, gracias por siempre estar conmigo, por su apoyo incondicional, por siempre confiar en mi y por su cariño. Sin ustedes este logro no hubiera sido posible. Alvaro y Beto gracias por todas esas conversaciones que a pesar de la distancia me hicieron sentir como en casa, gracias por el apoyo que siempre me han dado. Esther y Kichis gracias por siempre recibirme con una sonrisa, por su cariño y apoyo. A mi abuelas Ana y Enriqueta gracias por acompañarme todos estos años en la distancia y siempre darme su cariño. A mi familia Torres y Rodríguez por siempre estar cuando los necesito.

Tack så mycket Lin, Svante, Alice, Theo, Daniel, Arvid, Louise, Jan, för att ni alltid ler mot mig och att ni har välkomnat mig till er underbara familj.

Ylva, tack så mycket för att du är en del av mitt liv, för att du har hjälpt och stöttat mig under alla dessa år, för att vi har skrattat, dansat, diskuterat vetenskap, politik, livet tillsammans, för att du alltid finns där och för att du vill upptäcka världen med mig. Mitt liv är nu tusen gånger bättre, och hos dig hittade jag äntligen ett hem. Kom alltid ihåg att du inte bara är min bästa vän, min bästa rådgivare, min förtrogna, men du är också mitt livs kärlek.

With love Santiago.

–The Universe which, in the supremeness of its symmetry, is but the most sublime of poems.

Eureka [extract], Edgar Allan Poe 1848.

Dynamics of the Oort Cloud and the Formation of Interstellar Comets • Santiago Torres Rodríguez