ExoPlanet News
An Electronic Newsletter

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Contents

1 Editorial

Dear readers,

Welcome to the August edition of the ExoPlanet News!

In this issue you will find abstracts of scientific papers, and an overview of exoplanet-related articles on astro-ph.

For the next month we look forward to your paper abstracts, job ads or meeting announcements. Also special announcements are welcome. As always, we would also be happy to receive feedback concerning the newsletter. The Latex template for submitting contributions, as well as all previous editions of ExoPlanet News, can be found on the ExoPlanet News webpage (http://nccr-planets.ch/exoplanetnews/).

The next issue will appear on September 13, 2022.

Lokesh Mishra
Daniel Angerhausen
Julia Venturini
Holly Capelo
Timm-Emanuel Riesens

2 Abstracts of refereed papers

Transit Light-curves for Exomoons: Analytical Formalism

Suman Saha[1,2], *Sujan Sengupta*[1]

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The Astrophysical Journal, in press (arXiv:2203.10881)

The photometric transit method has been the most effective method to detect and characterize exoplanets as several ground-based as well as space-based survey missions have discovered thousands of exoplanets using this method. With the advent of the upcoming next generation large telescopes, the detection of exomoons in a few of these exoplanetary systems is very plausible. In this paper, we present a comprehensive analytical formalism in order to model the transit light curves for such moon hosting exoplanets. In order to achieve analytical formalism, we have considered circular orbit of the exomoon around the host planet, which is indeed the case for tidally locked moons. The formalism uses the radius and orbital properties of both the host planet and its moon as model parameters. The co-alignment or non-coalignment of the orbits of the planet and the moon is parameterized using two angular parameters and thus can be used to model all the possible orbital alignments for a star-planet-moon system. This formalism also provides unique and direct solutions to every possible star-planet-moon three circular body alignments. Using the formula derived, a few representative light curves are also presented.

Download/Website: `https://arxiv.org/abs/2203.10881v2`

Contact: `suman.saha@iiap.res.in`

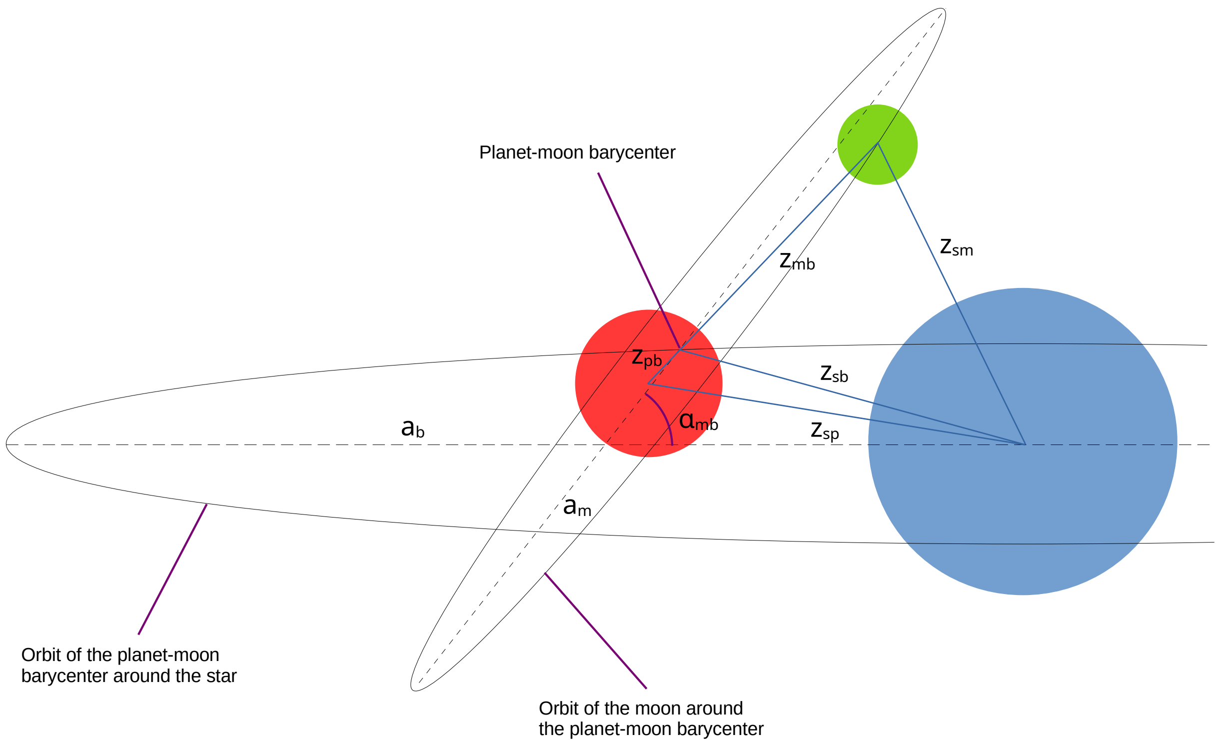

Figure 1: Orbital orientation of the star-planet-moon system from the observer's point of view, showing z_{sp}, z_{pm} and z_{sm}, the separations between the centers of the star and the planet, the planet and the moon, and the star and the moon respectively; z_{sb}, z_{pb} and z_{mb}, the separation of the planet-moon barycenter from the centers of the star, the planet and the moon respectively; α_{mb}, the angle between the major axes of the projected orbits of the planet-moon barycenter around the star and the moon around the planet-moon barycenter; a_b and a_m, the orbital semi-major axes of the planet-moon barycenter around the star and the moon around the planet-moon barycenter respectively.

Observation Scheduling and Automatic Data Reduction for the Antarctic telescope, ASTEP+

Georgina Dransfield[1] *et al.*

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SPIE Proceedings, in press

The possibility to observe transiting exoplanets from Dome C in Antarctica provides immense benefits: stable weather conditions, limited atmospheric turbulence, and a night that lasts almost three months due to the austral winter. However, this site also presents significant limitations, such as limited access for maintenance and internet speeds of only a few KB/s. This latter factor means that the approximately 6 TB of data collected annually must be processed on site automatically, with only final data products being sent once a day to Europe. In this context, we present the current state of operations of ASTEP+, a 40 cm optical telescope located at Concordia Station in Antarctica. Following a successful summer campaign, ASTEP+ has begun the 2022 observing season with a brand-new two-colour photometer with increased sensitivity. A new `Python` data analysis pipeline installed on a dedicated server in Concordia will significantly improve the precision of the extracted photometry, enabling us to get higher signal-to-noise transit detections. The new pipeline additionally incorporates automatic transit modelling to reduce the amount of manual post-processing required. It also handles the automatic daily transfer of the photometric lightcurves and control data to Europe. Additionally, we present the `Python` and web-based systems used for selection and scheduling of transit observations; these systems have wide applicability for the scheduling of other astronomical observations with strong time constraints. We also review the type of science that ASTEP+ will be conducting and analyse how unique ASTEP+ is to exoplanet transit research.

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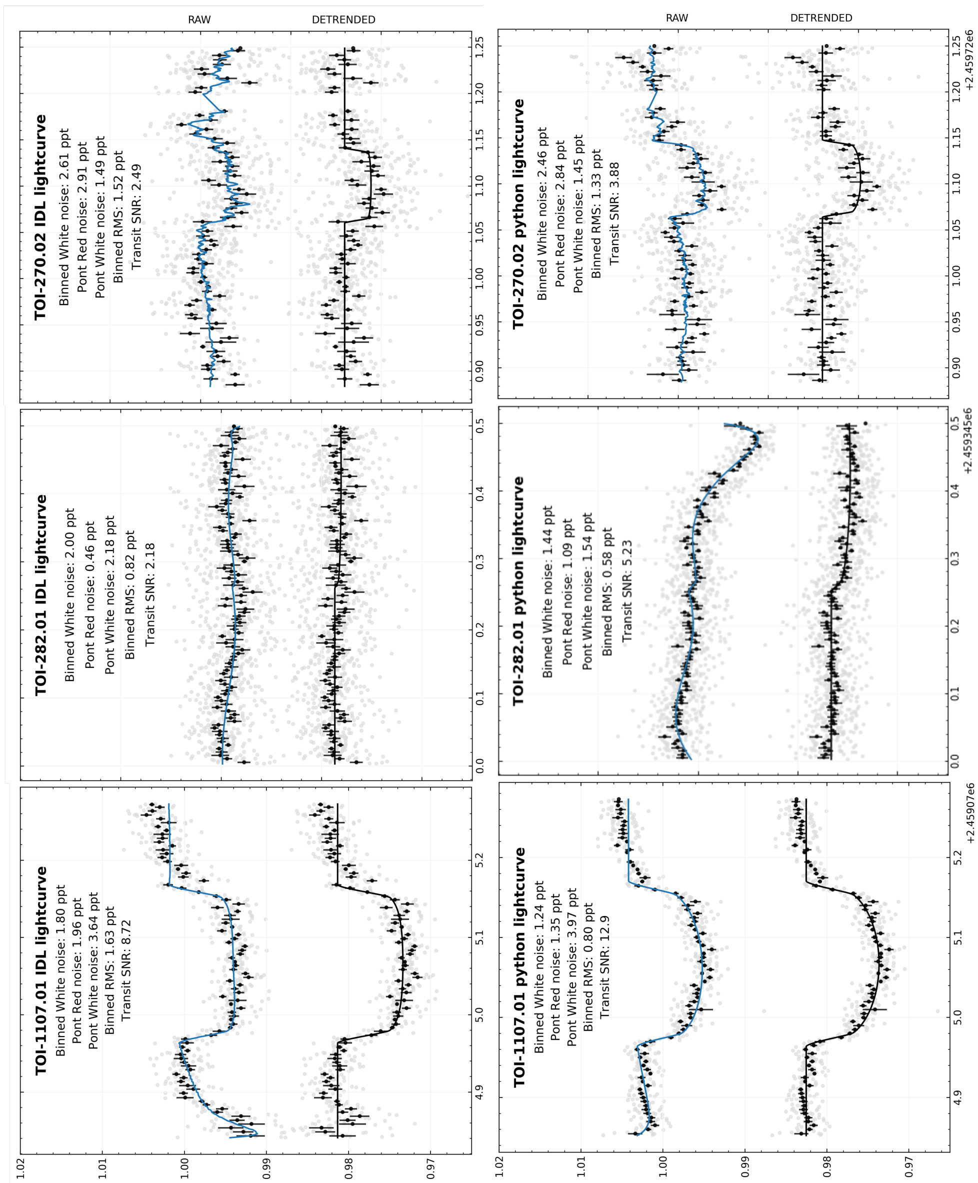

Figure 2: Comparison of lightcurves produced by the two pipelines. The upper panels show the lightcurves produced by the IDL pipeline, while the lower panels show the results of the Python pipeline. Grey points are normalised fluxes and black points are binned in 5 minute bins. The upper lightcurves are raw fluxes with the blue line indicating the systematics + transit model. The bottom lightcurves have had the systematics trend removed. Left panels: observation of TOI-1107.01 on 13 August 2020. Middle panels: observation of TOI-282.01 (now HD 28109 b) on 10 May 2021. Right panels: observation of TOI-270.02 (now TOI-270 d) on 21 May 2022.

A Criterion for the Stability of Planets in Chains of Resonances

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Icarus, published (arXiv:2207.13833)

Uncovering the formation process that reproduces the distinct properties of compact super-Earth exoplanet systems is a major goal of planet formation theory. The most successful model argues that non-resonant systems begin as resonant chains of planets that later experience a dynamical instability. However, both the boundary of stability in resonant chains and the mechanism of the instability itself are poorly understood. Previous work postulated that a secondary resonance between the fastest libration frequency and a difference in synodic frequencies destabilizes the system. Here, we use that hypothesis to produce a simple and general criterion for resonant chain stability that depends only on planet orbital periods and masses. We show that the criterion accurately predicts the maximum mass of planets in synthetic resonant chains up to six planets. More complicated resonant chains produced in population synthesis simulations are found to be less stable than expected, although our criterion remains useful and superior to machine learning models.

Download/Website: `https://arxiv.org/abs/2207.13833`

Contact: `mg@astro.caltech.edu`

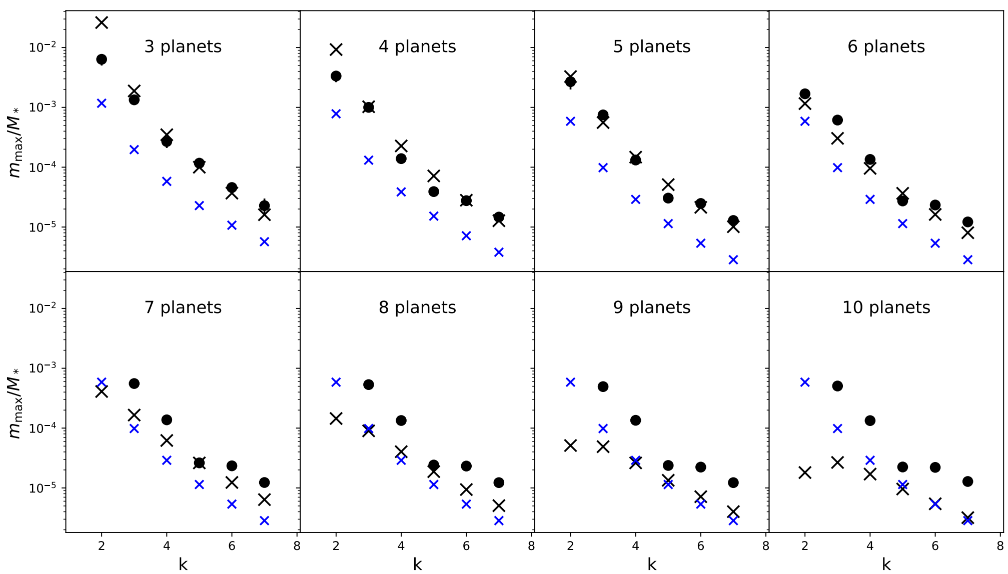

Figure 3: Maximum mass allowed by stability of planets locked into a chain of k:$k-1$ resonances, for different values of k and planet multiplicity. Black crosses mark our analytical estimate, while dots show the results of numerical simulations. The smaller blue crosses are the non-resonant stability boundary from Petit et al. (2020).

Formation of Comets

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Universe, published (doi:10.3390/universe8070381)

Questions regarding how primordial or pristine the comets of the solar system are have been an ongoing controversy. In this review, we describe comets' physical evolution from dust and ice grains in the solar nebula to the contemporary small bodies in the outer solar system. This includes the phases of dust agglomeration, the formation of planetesimals, their thermal evolution and the outcomes of collisional processes. We use empirical evidence about comets, in particular from the Rosetta Mission to comet 67P/Churyumov–Gerasimenko, to draw conclusions about the possible thermal and collisional evolution of comets.

Download/Website: `https://www.mdpi.com/2218-1997/8/7/381`

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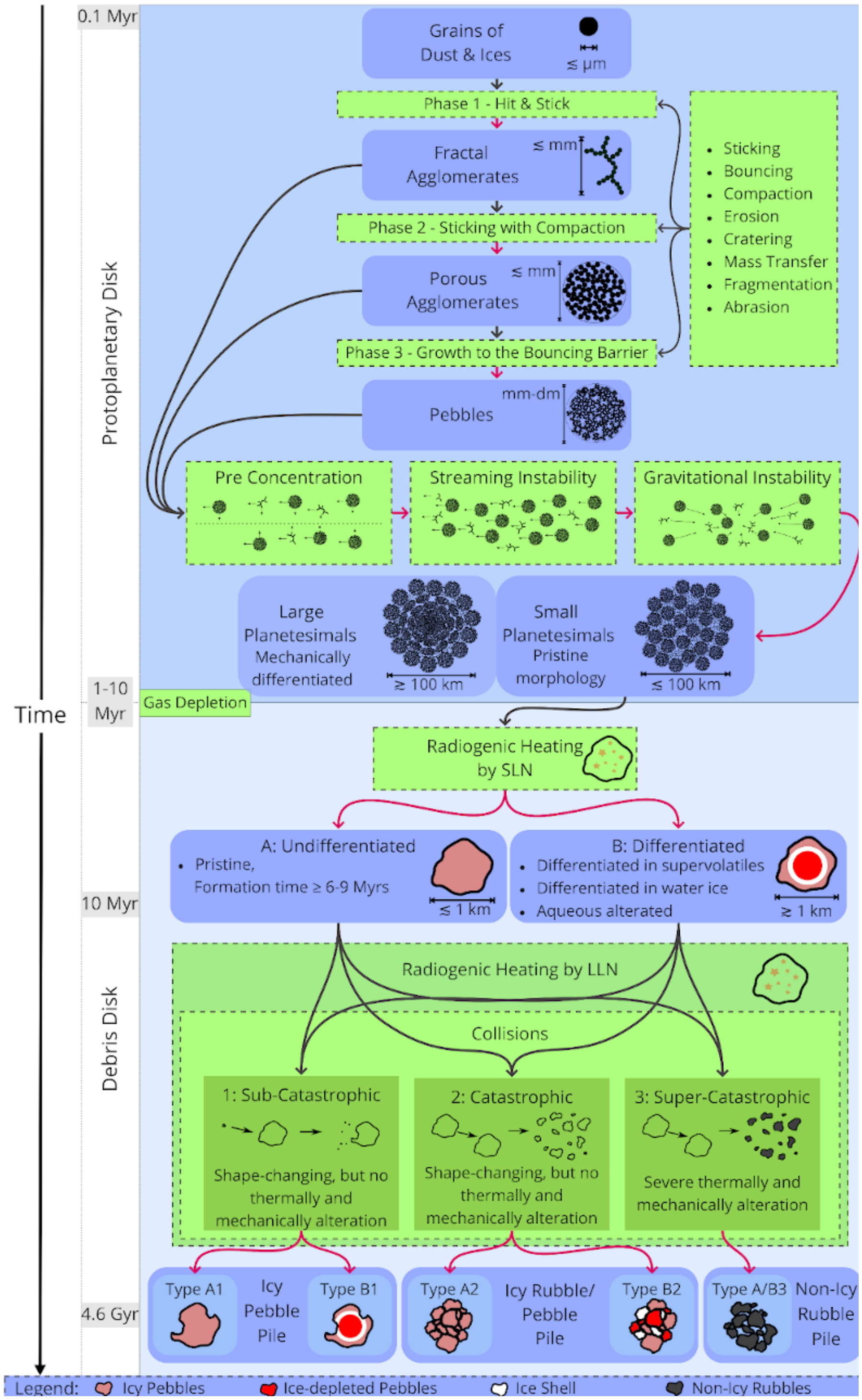

Figure 4: This overview is a graphical representation of the formation and evolution of planetesimals beyond the H_2O snowline. The blue and green backgrounds denote objects and processes, respectively. Each step is explained and discussed in the paper.

A search for transit timing variations in the HATS-18 planetary system

John Southworth[1], A. J. Barker[2], T. C. Hinse[3,4], Y. Jongen[5], M. Dominik[6], U. G. Jørgensen[7], P. Longa-Peña[8], S. Sajadian[9], C. Snodgrass[10], J. Tregloan-Reed[11], N. Bach-Møller[7,12], M. Bonavita[10], V. Bozza[13,14], M. J. Burgdorf[15], R. Figuera Jaimes[16], Ch. Helling[12,17], J. A. Hitchcock[6], M. Hundertmark[18], E. Khalouei[19], H. Korhonen[20], L. Mancini[21,22,23,24], N. Peixinho[25], S. Rahvar[26], M. Rabus[27], J. Skottfelt[28], P. Spyratos[1]

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MNRAS, in press (arXiv:2207.05873)

HATS-18 b is a transiting planet with a large mass and a short orbital period, and is one of the best candidates for the detection of orbital decay induced by tidal effects. We present extensive photometry of HATS-18 from which we measure 27 times of mid-transit. Two further transit times were measured from data from the Transiting Exoplanet Survey Satellite (TESS) and three more taken from the literature. The transit timings were fitted with linear and quadratic ephemerides and an upper limit on orbital decay was determined. This corresponds to a lower limit on the modified stellar tidal quality factor of $Q'_\star > 10^{5.11 \pm 0.04}$. This is at the cusp of constraining the presence of enhanced tidal dissipation due to internal gravity waves. We also refine the measured physical properties of the HATS-18 system, place upper limits on the masses of third bodies, and compare the relative performance of TESS and the 1.54 m Danish Telescope in measuring transit times for this system.

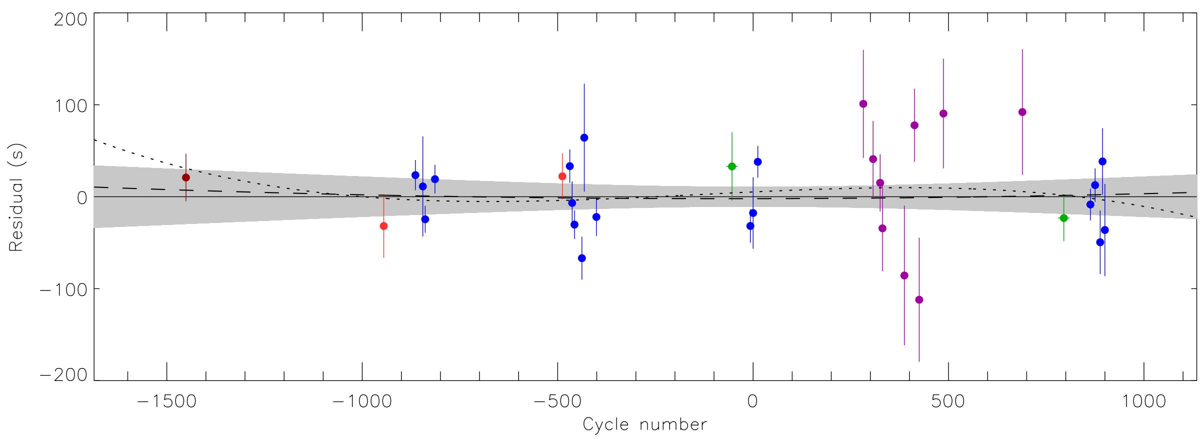

Figure 5: Plot of the residuals of the timings of mid-transit versus a linear ephemeris. Light red points indicate published timings, the dark red point is our analysis of the transit light curve from Penev et al. (2016), blue points are timings from the Danish telescope, purple from the Jongen telescope and green from TESS. The dashed line indicates the difference between the best-fitting linear and quadratic ephemerides, and the dotted line the difference between the linear and cubic ephemerides. The grey shade indicates the uncertainty in the linear ephemeris as a function of orbital cycle.

3 As seen on astro-ph

The following list contains exoplanet related entries appearing on astro-ph in July 2022.

July 2022

astro-ph/2207.00014: **Mantle mineralogy limits to rocky planet water inventories** by *Claire Marie Guimond, Oliver Shorttle, John F. Rudge*

astro-ph/2207.00015: **Stratospheric Clouds Do Not Impede JWST Transit Spectroscopy for Exoplanets with Earth-Like Atmospheres** by *Dhvani Doshi, Nicolas B. Cowan, Yi Huang*

astro-ph/2207.00101: **NEOSSat Observations of Three Transiting Hot Jupiters** by *Chris Fox, Paul Wiegert*

astro-ph/2207.00322: **DustPy: A Python Package for Dust Evolution in Protoplanetary Disks** by *Sebastian Markus Stammler, Tilman Birnstiel*

astro-ph/2207.00438: **The Resonant Tidal Evolution of the Earth-Moon Distance** by *Mohammad Farhat et al.*

astro-ph/2207.00634: **False positives and the challenge of testing the alien hypothesis** by *Searra Foote et al.*

astro-ph/2207.01496: **Distribution of solids in the rings of the HD 163296 disk: a multiwavelength study** by *G. Guidi et al.*

astro-ph/2207.01559: **Searching for Transit Timing Variations and Fitting a New Ephemeris to Transits of TrES-1 b** by *Paige Yeung et al.*

astro-ph/2207.01606: **A new method to correct for host star variability in multi-epoch observations of exoplanet transmission spectra** by *Vatsal Panwar et al.*

astro-ph/2207.01626: **Combined Effects of Disk Winds and Turbulence-Driven Accretion on Planet Populations** by *Matthew Alessi, Ralph E. Pudritz*

astro-ph/2207.01726: **2001 SN263 – the contribution of their irregular shapes on the neighborhood dynamics** by *Giulia Valvano et al.*

astro-ph/2207.02137: **Efficiently combining Alpha CenA multi-epoch high-contrast imaging data. Application of K-Stacker to the 80 hrs NEAR campaign** by *Hervé Le Coroller et al.*

astro-ph/2207.02236: **Water UV-shielding in the terrestrial planet-forming zone: Implications for carbon dioxide emission** by *Arthur D. Bosman et al.*

astro-ph/2207.02869: **Kinematic evidence for an embedded planet in the IM Lupi disc** by *Harrison J. Verrios et al.*

astro-ph/2207.03019: **Detection and characterization of planets orbiting oscillating red-giant stars with NASA's TESS mission** by *Filipe Pereira*

astro-ph/2207.03293: **The GAPS Programme at TNG XL: A puffy and warm Neptune-sized planet and an outer Neptune-mass candidate orbiting the solar-type star TOI-1422** by *L. Naponiello et al.*

astro-ph/2207.03479: **ACCESS: Confirmation of a Clear Atmosphere for WASP-96b and a Comparison of Light Curve Detrending Techniques** by *Chima D. McGruder et al.*

astro-ph/2207.03664: **Delivery of gas onto the circumplanetary disk of giant planets: Planetary-mass dependence of the source region of accreting gas and mass accretion rate** by *Natsuho Maeda et al.*

astro-ph/2207.03740: **Semi-supervised standardized detection of extrasolar planets** by *S. Sulis et al.*

astro-ph/2207.03748: **Stellar metallicity is a key parameter for the search of Life in the Universe** by *Giovanni Covone, Donato Giovannelli*

astro-ph/2207.03819: **Moderate-Resolution K-Band Spectroscopy of the Substellar Companion VHS 1256 b** by *Kielan K. W. Hoch et al.*

astro-ph/2207.03911: **Two long-period transiting exoplanets on eccentric orbits: NGTS-20 b (TOI-5152 b) and TOI-5153 b** by *S. Ulmer-Moll et al.*

astro-ph/2207.04006: **Reduced variations in Earth's and Mars' orbital inclination and Earth's obliquity from 58 to 48 Myr ago due to solar system chaos** by *Richard E. Zeebe*

astro-ph/2207.04063: **Water UV-Shielding in the Terrestrial Planet-Forming Zone: Implications for Oxygen-18 Isotope Anomalies in H2-18O Infrared Emission and Meteorites** by *Jenny K. Calahan, Edwin A.*

Bergin, Arthur D. Bosman

astro-ph/2207.04116: **Probing the innermost region of the AU Microscopii debris disk** by *A. Gallenne et al.*

astro-ph/2207.04138: **Morphology and dynamical stability of self-gravitating vortices: Numerical simulations** by *Steven Rendon Restrepo, Pierre Barge*

astro-ph/2207.04164: **Predictions for Observable Atmospheres of Trappist-1 Planets from a Fully Coupled Atmosphere-Interior Evolution Model** by *Joshua Krissansen-Totton, Jonathan J. Fortney*

astro-ph/2207.04252: **RoSSBi3D: a 3D and bi-fluid code for protoplanetary discs** by *Steven Rendon Restrepo, Pierre Barge, Radim Vavrik*

astro-ph/2207.04708: **Convective inhibition with an atmosphere, I: super-critical cores on sub-Neptune/super-Earths** by *Steve Markham, Dave Stevenson, Tristan Guillot*

astro-ph/2207.04891: **Minimoon still on the loose** by *Hadrien A. R. Devillepoix et al.*

astro-ph/2207.04987: **Revisiting fundamental properties of TiO2 nanoclusters as condensation seeds in astrophysical environments** by *J.P. Sindel et al.*

astro-ph/2207.05106: **No self-shadowing instability in 2D radiation-hydrodynamical models of irradiated protoplanetary disks** by *Julio David Melon Fuksman, Hubert Klahr*

astro-ph/2207.05199: **ATOCA: an algorithm to treat order contamination. Application to the NIRISS SOSS mode** by *Antoine Darveau-Bernier et al.*

astro-ph/2207.05277: **Multiwavelength Vertical Structure in the AU Mic Debris Disk: Characterizing the Collisional Cascade** by *David Vizgan et al.*

astro-ph/2207.05336: **Long-term tidal evolution of the TRAPPIST-1 system** by *R. Brasser et al.*

astro-ph/2207.05362: **Quadrupole and octupole order resonances in non-restricted hierarchical planetary systems** by *Hanlun Lei, Xiumin Huang*

astro-ph/2207.05759: **Dynamical Fates of S-Type Planetary Systems in Embedded Cluster Environments** by *Elizabeth A. Ellithorpe, Nathan A. Kaib*

astro-ph/2207.05760: **Early Stages of Planet Formation in Distorted Disks: Formation of Pressure Traps** by *Mor Rozner*

astro-ph/2207.05815: **Effects of Varying Land Coverage, Rotation Period, and Water Vapor on Equatorial Climates that Bridge the Gap between Earth-like and Titan-like** by *Matthew McKinney et al.*

astro-ph/2207.05873: **A search for transit timing variations in the HATS-18 planetary system** by *John Southworth et al.*

astro-ph/2207.05874: **VLT, GROND and Danish Telescope observations of transits in the TRAPPIST-1 system** by *John Southworth et al.*

astro-ph/2207.05923: **Molecules with ALMA at Planet-forming Scales (MAPS). A Circumplanetary Disk Candidate in Molecular Line Emission in the AS 209 Disk** by *Jaehan Bae et al.*

astro-ph/2207.05963: **Detection Feasibility of H2 in Ultra-hot Jupiter Atmospheres** by *Anastasia Morgan et al.*

astro-ph/2207.06024: **Analytic Light Curve for Mutual Transits of Two Bodies Across a Limb-darkened Star** by *Tyler A. Gordon, Eric Agol*

astro-ph/2207.06077: **How drifting and evaporating pebbles shape giant planets III: The formation of WASP-77A b and Boötis b** by *Bertram Bitsch, Aaron David Schneider, Laura Kreidberg*

astro-ph/2207.06434: **The Dynamical Viability of an Extended Jupiter Ring System** by *Stephen R. Kane, Zhexing Li*

astro-ph/2207.06511: **A Tendency Toward Alignment in Single-Star Warm Jupiter Systems** by *Malena Rice et al.*

astro-ph/2207.06525: **HST/WFC3 H Direct-Imaging Detection of a Point-like Source in the Disk Cavity of AB Aur** by *Yifan Zhou et al.*

astro-ph/2207.06570: **Less effective hydrodynamic escape of H2-H2O atmospheres on terrestrial planets orbiting pre-main sequence M dwarfs** by *Tatsuya Yoshida et al.*

astro-ph/2207.06622: **X-SHYNE: X-shooter spectra of young exoplanet analogs. I. A medium-resolution 0.65-2.5m one-shot spectrum of VHS 1256-1257 b** by *Simon Petrus et al.*

astro-ph/2207.06974: **Atmospheric gravitational tides of Earth-like planets orbiting low-mass stars** by *Thomas Navarro et al.*

astro-ph/2207.07144: **Aiolos- A multi-purpose 1-D hydrodynamics code for planetary atmospheres** by *Matthäus Schulik, Richard Booth*

astro-ph/2207.07171: **An ALMA 1.3 millimeter Search for Debris Disks around Solar-type Stars in the Pleiades** by *Devin Sullivan et al.*

astro-ph/2207.07295: **Mass Production of 2021 KMTNet Microlensing Planets II** by *Yoon-Hyun Ryu et al.*

astro-ph/2207.07456: **Unbiasing the density of TTV-characterised sub-Neptunes: Update of the mass-radius relationship of 34 Kepler planets** by *A. Leleu et al.*

astro-ph/2207.07551: **Ionizing Protoplanetary Disks in Pebble Collisions** by *Gerhard Wurm, Felix Jungmann, Jens Teiser*

astro-ph/2207.07569: **Detectability of satellites around directly imaged exoplanets and brown dwarfs** by *Cecilia Lazzoni et al.*

astro-ph/2207.07617: **A Bayesian Monte Carlo assessment of orbital stability in the late stages of planetary system formation** by *Jassyr Salas, Frank Bautista, Germán Chaparro*

astro-ph/2207.07670: **On the Effects of Planetary Oblateness on Exoplanet Studies** by *David Berardo, Julien DeWit*

astro-ph/2207.07678: **Radial Profiles of Surface Density in Debris Discs** by *Roman R. Rafikov*

astro-ph/2207.07960: **Standing solitary waves as transitions to spiral structures in gravitationally unstable accretion disks** by *Hongping Deng, Gordon I. Ogilvie*

astro-ph/2207.08084: **Planetary systems with forces other than gravitational forces** by *Søren Toxvaerd*

astro-ph/2207.08125: **Directional aspects of vegetation linear and circular polarization biosignatures** by *C.H. Lucas Patty et al.*

astro-ph/2207.08156: **Stochastic accretion of the Earth** by *Paolo A. Sossi et al.*

astro-ph/2207.08587: **External or internal companion exciting the spiral arms in CQ Tau?** by *Iain Hammond et al.*

astro-ph/2207.08600: **Toward a Population Synthesis of Disks and Planets I. Evolution of Dust with Entrainment in Winds and Radiation Pressure** by *Remo Burn et al.*

astro-ph/2207.08636: **The bright side of the light curve: a general photometric model of non-transiting exorings** by *Jorge I. Zuluaga (SEAP/FACOM/UdeA), Mario Sucerquia (NPF/UV), Jaime A. Alvarado-Montes (RCAAA/Macquarie University)*

astro-ph/2207.08742: **Sub-stellar Companions of Intermediate-mass Stars with CoRoT: CoRoT-34b, CoRoT-35b, and CoRoT-36b** by *D. Sebastian et al.*

astro-ph/2207.08827: **Vertically extended and asymmetric CN emission in the Elias 2-27 protoplanetary disk** by *T. Paneque-Carreño et al.*

astro-ph/2207.08858: **Turbulent Dust-trapping Rings as Efficient Sites for Planetesimal Formation** by *Ziyan Xu, Xue-Ning Bai*

astro-ph/2207.08889: **The Detectability of Rocky Planet Surface and Atmosphere Composition with JWST: The Case of LHS 3844b** by *Emily A. Whittaker et al.*

astro-ph/2207.08917: **TESS Observations of Kepler systems with Transit Timing Variations** by *Daniel Jontof-Hutter, Paul A. Dalba, John H. Livingston*

astro-ph/2207.08993: **Machine Learning in Orbit Estimation: a Survey** by *Francisco Caldas, Cláudia Soares*

astro-ph/2207.09027: **Water shielding in the terrestrial planet-forming zone: Implication for inner disk organics** by *Sara E. Duval (1), Arthur D. Bosman (1), Edwin A. Bergin (1) ((1) University of Michigan)*

astro-ph/2207.09269: **On the Slow Drift of Solstices: Milankovic Cycles and Mean Global Temperature** by *F. Lopes et al.*

astro-ph/2207.09351: **Salty ice and the dilemma of ocean exoplanet habitability** by *Baptiste Journaux*

astro-ph/2207.09665: **ExoSGAN and ExoACGAN: Exoplanet Detection using Adversarial Training Algorithms** by *Cicy K Agnes, Akthar Naveed V, Anitha Mary M O Chacko* astro-ph/2207.09752: **Close encounters: How stellar flybys shape planet-forming discs** by *Nicolás Cuello, François Ménard, Daniel J. Price*

astro-ph/2207.09760: **The GAPS Programme at TNG XXXVIII. Five molecules in the atmosphere of the warm giant planet WASP-69b detected at high spectral resolution** by *G. Guilluy et al.*

astro-ph/2207.09761: **The GAPS Programme at TNG XXXIX – Multiple molecular species in the atmosphere of the warm giant planet WASP-80 b unveiled at high resolution with GIANO-B** by *Ilaria Carleo et al.*

astro-ph/2207.09795: **Anatomy of rocky planets formed by rapid pebble accretion I. How icy pebbles determine the core fraction and FeO contents** by *Anders Johansen , Thomas Ronnet , Martin Schiller , Zhengbin Deng , Martin Bizzarro*

astro-ph/2207.09804: **Anatomy of rocky planets formed by rapid pebble accretion II. Differentiation by accretion energy and thermal blanketing** by *Anders Johansen , Thomas Ronnet , Martin Schiller , Zhengbin Deng , Martin Bizzarro*

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