Publ. Astron. Obs. Belgrade No. 96 (2017), 371 - 372 *Poster*

POSSIBLE EXOMOONS AS TARGETS FOR SETI

D. LUKIĆ

Institute of Physics, Pregrevica 118, 11000 Belgrade, Serbia
E–mail: lukic@ipb.ac.rs

Abstract. Using data from Planetary Habitability Labaratory Exoplanet Catalogue we find exoplanets possible to have big enough satellites to host life. We sugest radio astronomy based methods to search for life on a possible exomons.

1. INTRODUCTION

One of the leading models describing planetary satellites formation comes from a series of papers developed by (Canup & Ward 2006) and it is known as the actively supplied gaseous accretion disk model. Dust grains within a circumplanetary disk stick and grow to form satellitesimals, which then migrate via type I migration. Continuous mass-infall from the protoplanetary disk maintains a peak circumplanetary disk density of approximately 100 gcm^{-2}, allowing new satellitesimals to continuously grow. Once the planet has opened up a gap in the protoplanetary disk, the active supply halts and the circumplanetary disk rapidly diffuses in 10^3 yrs, thus freezing the remaining satellites in place.

The mass fraction of satellite system is regulated to approximately 10^{-4} M_P, where M_P is mass of planet (Canup & Ward 2006), by a balance of two competing processes: the supply of in owing material to the satellites, and satellite loss through orbital decay driven by the gas. An alternative model is the solids enhanced minimum mass model (see e.g. Masqueira & Estrada 2003). In this model a much longer satellite migration timescale is present than the associated formation timescale. The model only qualitatively describes the expected mass ratios, unlike the actively supplied disk accretion.

1. 1. SELECTION OF DATA AND METHOD OF ANALYSIS

Most of the detected exoplanets are gas giants, many of which are in the habitable zone. These gas giants cannot support life, but it is believed that the exomoons orbiting these planets could still be habitable. In our analysis, assuming that scaling law (Canup & Ward 2006) observed in the solar system also applies for extrasolar super-Jupiters (Heller & Pudritz 2014), we used planet's data from Planetary Habitability Laboratory Exoplanets orbital catalog and we selected only planets in the habitable zones more massive than Jupiter. They are presented in Table 1. We can see that

Table 1: Possible exomoons

Planet Name	*Mass*	*Star type*	*Distance*	*Satellite mass*
HD 10697 b	6.38 M_J	G star	106 ly	0.20 $M_\oplus$
HD 28185 b	5.7 M_J	F star	138 ly	0.18 $M_\oplus$
HD 23596 b	8.1 M_J	F star	169 ly	0.25 $M_\oplus$
HD 13908 c	5.13 M_J	F star	232 ly	0.16 $M_\oplus$
ups And d	10.19 M_J	F star	44 ly	0.32 $M_\oplus$
Kepler 419 c	7.19 M_J	Fstar	-	0.22 $M_\oplus$

selected planets orbit F and G stars. Maximum masses of possible satellites are all bigger than Mars mass.

Since we could not find exomoons with existing optical astronomy methods at least 10 years from present (Kipping 2014) we suggest to search for exomoons around these planets with radio astronomy based methods (see e.g. Noyola et all 2014) or SERENDIP (see e.g. SERENDIP) for extraterrestrial intelligence on possible exomoons.

Acknowledgment

During the work on this paper the author was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia through project no. 176021 "Visible and invisible matter in nearby galaxies: theory and observations".

References

Canup, R. M. and Ward, W. R.: 2006, *Nature*, **441**, 834.
Heller, R. and Pudritz R.: 2014, http://arxiv.org/abs/1410.5802
Kipping D. M.: 2014, http://arxiv.org/abs/1405.1455v1 to appear in the proceedings for the Frank N. Bash Symposium 2013: New Horizons in Astronomy, held October 6-8, 2013 in Austin, TX.
Masqueira, I. and Estrada, P. R.: 2003, *Icarus* **163**, 198.
Noyola, J. P., Satyal, S. and Musielak Z. E.: 2014, *Astrophys. J.* **791**, 25.
Planetary Habitability Laboratory http://phl.upr.edu/projects/habitable-exoplanets-catalog/catalog
SERENDIP seti.berkeley.edu/serendip/