Star Cluster Dynamics and Evolution
- ***COURSE SYLLABUS***

1.	**Course title:**	
	Star Cluster Dynamics and Evolution	
2.	**Lecturer:**	
	Mirek Giersz and Abbas Askar	
3.	**Field, type and level of studies, year of study:**	
	astrophysics, collisional stellar dynamics, all years of study	
4.	**Course character:**	
	monographic lecture	
5.	**Teaching method:**	
	hybrid	
6.	**Language:**	*English*
7.	**Course type and number of hours:**	
	lectures 30h	
8.	**Estimated load of student's independent work:**	*30h*
9.	**Total workload and number of ECTS points:**	*60 h, 3 ECTS*
10.	**Short description and main focus of the course:**	
	Star clusters are important astrophysical laboratories for stellar evolution and dynamics. In this course, we will introduce the key concepts of stellar dynamics and will study the physical processes that drive the evolution of dense star clusters. We will discuss numerical modeling of star cluster evolution through simulations. The strengths and weaknesses of direct N-body and Monte Carlo methods will also be explained. Finally, we will cover how the interplay between dynamics and evolution can produce gravitational wave sources and stellar exotica in star clusters. The course will also introduce students to analyzing simulation data to infer meaningful information about present-day clusters and their evolutionary history.	
11.	**References:**	
	- *Henon's Lecture on Stellar Dynamics*	

	- *Dynamical Evolution of Globular Clusters (Spitzer)* - *Galactic Dynamics (Binney & Tremaine)* - *Gravitational Million Body Problem (Hut & Heggie)* *Other relevant material will be provided during the class*	
12.	**Prerequisites:** *Basic experience with data analysis using scripts will be helpful.*	
13.	**Educational outcomes:**	**PQF level 8 codes:**
	Knowledge: *Students are able to understand the most important processes involved in the evolution of star clusters. They are able to distinguish between collisional and collisionless dynamical systems. They understand the numerical methods and techniques used in star cluster simulation codes. They are also able to understand the astrophysical importance of star clusters in producing gravitational wave sources and stellar exotica.*	*P8S_WG*
	Practical Skills: *Students are able to analyze and draw meaningful astrophysical conclusions from simulation data. Are able to write simple scripts and tools to handle large data. The course will also require them to develop their presentation and writing skills. Students will be able to read and understand scientific papers on star cluster dynamics and evolution.*	*P8S_UW, P8S_UK*
	Social Skills: *Students are able to understand the astrophysical importance of studying star clusters and discuss topics in stellar dynamics with experts and colleagues. Students can critically evaluate arguments presented in scientific discussions and papers.*	*P8S_KK*
14.	**Evaluation of the educational outcomes:** - *Student Presentations* - *1 Take Home Exam which will include analyzing simulation data*	
15.	**Criteria to complete the course:** *80% of course attendance and completion of student presentation and take home exam*	
16.	**Contact with the lecturer:** *Via email: mig@camk.edu.pl* (Mirek) and *askar@camk.edu.pl*, (Abbas)	