**华南理工大学第十四届物理学术竞赛**

**组队要求与竞赛题目**

**(2025.9.30制定)**

**一、组队要求**

一支队伍由5人组成，且需要安排1名学生作为联络人（队长）。成员具体要求如下：

①成员必须是具有华南理工大学全日制学籍的本科生；

②允许并鼓励跨年级、跨学院、跨校区组队；

③原则上为5人1组，每组每人至少选择一道题目，即每组至少完成5道题目，按国赛要求，每个队伍可以拒绝五道题不扣分，每队具体完成几道题目，请自行考量；

④各成员应遵守学术研究基本行为准则，对出现以下行为者，物理与光电学院有权做出禁赛处分：

1）刻意隐瞒自己的年级、真实姓名等信息；

2）存在学术不端或学术造假行为；

3）在比赛过程中辱骂裁判、比赛成员、观众行为的；

4）其他未指明的容易造成不良后果的不良行为。

⑤如果在比赛中的任一阶段，出现队伍成员退赛的情况，请及时与工作人员联系，若队伍成员仅剩1-2人，工作人员将强制将其与其余成员组队。

⑥在一个队伍中，每位队员应至少负责一道题目，若存在一人负责多道题目的情况，请在报名时写明。

**二、比赛赛题**

华南理工大学第十四届物理学术竞赛比赛赛题如下：

**1. Invent yourself**

A self-starting siphon can be made using a piece of rigid tubing bent into a specific shape. When the siphon is partially immersed in water, it begins siphoning water without the need for initial suction. Investigate how the relevant parameters, such as the geometry, affect the siphoning process.

**2. Electrical damping**

A magnet suspended by a spring will display simple harmonic motion when displaced. If the magnet oscillates within a coil connected to a resistor, its motion will be damped. Investigate the factors that affect the damping.

**3. Ring fountain**

When a flat metal ring falls from a certain height into a water tank, it generates a fountain that can shoot water high into the air. How does the maximum height of the fountain depend on the ring's parameters?

**4. Oil flow**

A thin layer of cooking oil on a flat metal surface flows outwards when heated.Investigate the phenomenon and its dependence on relevant parameters.

**5. Elastic wave dynamics**

Suspend a metal ball from a fixed support using a rubber band and twist it many times around its vertical axis. When the ball is released, standing waves are formed on the rubber band. Investigate this phenomenon and study

how the wave depends on relevant parameters.

**6. Flipo Flip**

A Flipo Flip toy can roll for multiple turns even though its shape is not circular.Investigate how its motion depends on parameters such as geometry and the initial release conditions.

**7. Tennis racket theorem**

When an object with different principal moments of inertia about each axis is thrown while it rotates, it can suddenly start rotating around an axis different from the one it was initially rotating about. Investigate how the rotational motion of such an object is affected by relevant parameters during its free fall.

**8. Magnetic accelerator**

Fix magnets in pairs onto a metal sheet as shown. If you attach two magnetic discs onto an axle this "vehicle" will accelerate over the rows of magnets under certain

conditions. Investigate the phenomenon.

**9. Levitation control**

When arranged in a specific configuration, small graphite sheets can levitate on neodymium magnets. By shining light onto the surface of the graphite sheet, it is possible to control its movement. Explain and investigate the phenomenon.

**10. Submerged crater**

If you release sand or similar granular material in a container filled with water, the material will sink to the bottom and may form a crater-like structure. Explain and investigate the phenomenon.

**11. Sweet monochromator**

Pass linearly polarised white light through a column of sugar solution. When transmitted light is observed through a polariser it may appear coloured. Rotate the

polariser, and the transmitted light colour may change. Construct such a sweet monochromator and optimise for the narrowest light wavelength bandwidth.

**12. Autumn coin**

The motion of a coin falling to the bottom of a tank filled with liquid can be remarkably similar to the fluttering and tumbling of a falling autumn leaf. Investigate how the motion of the coin depends on relevant parameters.

**13. The singing ruler**

When a ruler is clamped at one end and struck, it oscillates and emits a characteristic sound. Investigate how the sound depends on relevant parameters.

**14. Crystal Critters**

Observe the evaporation of a drop of table salt solution on a warm hydrophobic surface. After the water evaporates, a variety of characteristic crystal shapes

remain. Research and explain this phenomenon.

1. **Magnetic Newton's cradle**

Repulsing, non-touching magnets are used instead of colliding balls to make a new type of Newton's cradle. The new cradle can act in a similar way to a regular cradle, but can also exhibit other interesting behaviour. Explain and study the movement of this magnetic cradle.

**16. Twisted spaghetti**

When a bundle of spaghetti is twisted, it might withstand higher transverse (side) forces than a straight, untwisted bundle. Investigate the response of a twisted bundle to transverse stress and identify the optimal twist that maximises tolerance to transverse stress.

**17. Travelling flame**

A flame can propagate continuously around a ringshaped trough containing a thin layer of flammable liquid. Investigate how the characteristics of this travelling flame

depend on relevant parameters.