第五届西南地区大学生物理学术竞赛暨第十二届中国大学生物理学术竞赛西南地区预选赛第一轮通知

西南地区各高校教务处：

中国大学生物理学术竞赛（CUPT）是中国借鉴国际青年物理学家锦标赛（IYPT）的模式创办的国内全国性赛事。该项活动得到了教育部的支持，是实践国家教育中长期发展规划纲要的重要大学生创新竞赛活动之一。 CUPT 已经在全国连续举办了 11 届，以其独特的竞赛模式和理念吸引了越来越多的知名高校和物理精英参与，并已成为国内具有重要影响力的大学生物理竞技赛事之一。

基于 CUPT 活动对大学生的创新意识、创新能力、协作精神和实践能力方面具有独特的作用，在借鉴华东地区、西北地区和东北地区的大学生物理学术竞赛经验的基础上，由教育部高等学校物理学类专业教学指导委员会西南地区分委会、四川省物理学会、西南地区各高校一起倡导，在西南地区举办西南地区大学生物理学术竞赛（SWUPT），以提升西南地区大学生的物理科研素养和创新意识，加强各高校大学生及教师之间的学术交流，为落实学校培养高素质本科生和创新人才培养注入新动力。由教育部高等学校物理学类专业教学指导委员会西南地区分委会、四川省物理学会主办，西南医科大学承办的“第五届西南地区大学生物理学术竞赛”拟定于 2021 年 5 月底到 6 月初（具体时间详见第二轮通知）在西南医科大学城北校区举行，欢迎高校师生前来参加比赛或观摩交流。现将有关事项通知如下。

一、赛事要求

1. 每所参赛学校可派 1-2 支代表队和 1-2 名领队，每支代表队由 5 名学生选手组成，领队可由教师或学生担任。
2. 每所观摩学校必须有领队带队，观摩人数最多 8 人，观摩人员可以是老师或学生。
3. 受比赛规则限制，报名参赛代表队必须参加比赛，不得临时退出。
4. SWUPT 竞赛规则参照 IYPT 比赛规则，竞赛工作语言为中文。
5. 第五届 SWUPT 试题采用第 34 届 IYPT 问题中的 12 道题(题号为：2、4、5、6、7、8、9、10、11、12、15、16)（详见附录 1）。
6. 各参赛和观摩高校推荐裁判要求：

参赛高校：若派 1 支参赛代表队，请至少推荐 2 名裁判；若派 2 支参赛代表队，请至少推荐 3 名裁判。观摩高校：请推荐 1 名裁判。**（请裁判务必提前熟悉比赛题目和相关研究内容）**

二、赛事安排

1. 报名方式与时间：请拟参赛高校将报名回执（附件 1 及附件 2）（如人员未定，可只发领队信息），于 2021 年 2 月 1 日前发至竞赛邮箱：SWUPT2021@163.com
2. 欢迎加入西南地区 CUPT 微信群（由于现有人数较多，需要邀请入群）。
3. 报名费：教师领队和裁判 900 元/人，参赛学生和学生领队 800 元/人，观摩师生 700 元/人。
4. 会议期间食宿统一安排，费用自理。

三、联系方式

1. 通讯地址：西南医科大学城北校区医学信息与工程学院，泸州市龙马潭区香林路 1 段 1 号。

邮编：64600

2. 联系人:贺 兵，手机：15881988880 邮箱：SWUPT2021@163.com

冯德龙，手机：13261522093 邮箱：fengdl@swmu.edu.cn

有关第五届 SWUPT 筹备情况及相关信息，我们将在微信群里及时公布，欢迎各位老师和学生在微信群里提出建议和指导。

教育部高等学校物理学类专业教学指导委员会西南地区分委会

(西南医科大学医学信息与工程学院代章)

四川省物理学会

西南医科大学医学信息与工程学院

2020/12/15

Problems for the 34th IYPT 2021

1. Invent Yourself

Design a boat that moves only due to the periodical mechanical movements of its internal parts and which only interacts with the environment (air, water) through its stiff hull. Optimise the parameters of your boat for maximum speed.

2. Circling Magnets

Button magnets with different diameters are attached to each end of a cylindrical battery. When placed on an aluminium foil the object starts to circle. Investigate how the motion depends on relevant parameters.

3. Proximity Sensor

A simple passive inductive sensor can detect ferromagnetic objects moving through its magnetic field. Construct such a passive sensor and investigate its characteristics such as sensing range.

4. Wind Speed

Let an electric current flow through a coil. When cold air flows over the coil, the coil's temperature will decrease. Investigate how the temperature drop depends on the wind speed. What is the accuracy of this method of measuring the wind speed?

5. Synchronised Candles

Oscillatory flames can be observed when several candles burn next to each other. Two

such oscillators can couple with each other, resulting in in-phase or anti-phase synchronisation (depending on the distance between the sets of candles). Explain and investigate this phenomenon.

6. Irreversible Cartesian Diver

A simple Cartesian diver (e.g. an inverted test tube partially filled with water) is placed in a long vertical tube filled with water. Increasing the pressure in the tube forces the Cartesian diver to sink. When it reaches a certain depth, it never returns to the surface even if the pressure is changed back to its initial value. Investigate this phenomenon and how it depends on relevant parameters.

7. Bead Dynamics

A circular hoop rotates about a vertical diameter. A small bead is allowed to roll in a groove on the inside of the hoop. Investigate the relevant parameters affecting the dynamics of the bead.

8. Fuses

A short length of wire can act as an electrical fuse. Determine how various parameters affect the time taken for the fuse to ‘blow’.

9. Light Whiskers

When a laser beam enters a soap film at a small angle, a rapidly changing pattern of

thin, branching light tracks may appear inside the film. Explain and investigate this phenomenon.

10. Spin Drift

When a ring is set to roll in a parabolic bowl, interesting motion patterns may arise. Investigate this phenomenon.

11. Guitar String

A periodic force is applied to a steel guitar string using an electromagnet. Investigate the motion of the guitar string around its resonance frequency.

12. Wilberforce Pendulum

A Wilberforce pendulum consists of a mass hanging from a vertically oriented helical spring. The mass can both move up and down on the spring and rotate about its vertical axis. Investigate the behaviour of such a pendulum and how it depends on relevant parameters.

13. Sponge

A sponge will soak up water at a rate and in a quantity determined by various parameters. Investigate how effective a sponge is at drying a wet surface.

14. Dynamic Hydrophobicity

When a drop of liquid impacts on a horizontally moving surface, the droplet may be

reflected or not, depending on the speed of the surface. Investigate the interaction between a moving surface and a liquid drop.

15. Rebounding Capsule

A spherical ball dropped onto a hard surface will never rebound to the release height, even if it has an initial spin. A capsule-shaped object (i.e. Tic Tac mint) on the other hand may exceed the initial height. Investigate this phenomenon.

16. Ultrasonic Pump

A capillary immersed in an ultrasonic bath works like a pump that can lift water to a considerable height. Explain and investigate this phenomenon.

17. Hand Helicopter

A simple hand helicopter can be made by attaching rotor blades to one end of a vertical stick. The helicopter moves upwards when the stick is twisted at a high enough speed and then let go. Investigate how the relevant parameters affect the lift-off and the maximum height.