The International Physicists' Tournament statement on the use of AI

Dear members of the IPT Community,

we reached the stage when the growth and spread of the machine learning/artificial intelligence technologies penetrates daily life and all kinds of leisure, business and educational activities. We recognise the impact of the technologies on the core components of the IPT as a competitive event and as an educational experience. Saying that, in this document, we introduce the guidance on the ethical and responsible use of AI in the context of the physics tournament.

General guidance on the use of AI

Keep in mind research ethics in terms of citing earlier works: if your study relies on ideas or results from existing research literature, the source must be cited. The AI tools tend to generate fake sources so you must ensure that the info from an AI tool output is present in the original manuscript by searching and reading it.

We encourage you to provide an explicit declaration of the use of AI tools for the report or presentation preparation. You may want to specify certain tasks where you relied on the assistance of any AI tools: idea generation, data analysis, code writing and debugging, text polishing, slides arrangement etc.

Keep handy the original raw data, photos from the experiments, scripts for data analysis, manuscripts you cite, it may be needed to resolve the potential issues.

AI in preselection reports

Reports that keep themselves to providing a theory-only understanding of physics will be highlighted as more limited. The writings with a lack of unique analysis and artefacts of the AI writing will be flagged at the first round of the preselection marking to be addressed in revision.

Participants are encouraged to provide experimental proof during the preselection reports in media format. Be prepared to send at least one experimental video that your team used for the report, indicating specific quantities and analysis performed.

AI during Physics Fights

As for the IPT "Physics Fights" themselves, we believe that this perspective of the never-ending interest and generativity of experimental work will be shared among most

students such that conversations regarding the absence of experimental work will happen and be judged adequately by the jury without need of further guidance. The jury and students who have performed the investigations in an experimental format will notice work that is overly theoretical and surface-like. Such work that would make good use of AI's analytical skills will inevitably pop out negatively when in-depth discussions about the physics of the problems will take place between participants.

AI tools can produce speeches and content analysis similar to what students should perform during a speech by the opponent or a speech by the moderator. The ability to assess the information contained in a scientific presentation is something we will not waive. Therefore, we ban the usage of AI during Physics Fights, so that the competition is fair between students themselves.

Students should be accountable for their own experiments and theoretical propositions, so that the complete investigation of a problem shows the unique path each team took from assumptions, to hypotheses, experiments, to theories and conclusions. The teams should be prepared to provide presentations/videos and other proof to a Scientific Committee during the IPT week, as a form of verification of work authenticity. More details will be provided on this as we move closer to the actual competition.

Why we publish this guidance and why now

To start with, the use of AI is not a problem in itself. Many researchers use it nowadays: to write code, to help with complex data analysis, to ask physical questions where one is curious to hear what a non-human thinking engine will respond, to see how it thinks. Some even use it to write their emails and do the required administrative work. We evidently do not expect students to behave differently. But this does not mean that AI can be the basis of your report, or of any investigation into physics problems (for the IPT, and not even beyond!). The AI tools cannot be accountable for ideas or research outcomes. Whenever you use the AI tools, verify the outcome in other ways. It is you who owns the outcome, not the AI.

The IPT is a space for students to explore for the first time what it means to produce scientifically-based knowledge. Said otherwise, the project of the IPT is to build a pedagogical structure that educates students in the process of scientific research. We hope they learn what *laboratory life* is, and as such become better prepared for their future careers in academic or non-academic positions as we believe that science and knowledge production permeate our contemporary life and are crucial abilities to solve humanity's most pressing problems.

The problems of the IPT are formulated in an open-ended way. Due to their nature, they drift away from the dual lectures-exercises and practical work where answers to

problems are known to exist in advance. They usually take a threefold form: (1) description of the phenomenon, (2) demand to explain the phenomenon, (3) a couple of questions to orient the research and ground the discussion between the participating teams.

While students will develop skills while undergoing the innovative IPT pedagogical experience, our primary task is not to give students a restricted set of “techniques” that they should learn to master as is traditionally done in science education.

The goal of the IPT is to question students into making a good scientific investigation, and find explanations of physical phenomena. This is a tremendously difficult task to do, far from the techniques of traditional education. In this framework, the problems of IPT are formulated so as to involve a strong flavor of experimental work. As is often said, physics is an experimental science, and theoretical investigation should only be done so as to come in discussion with the observed phenomena in the world. Experiments are always a source of surprise and should therefore be central in any IPT work.

This is where the question of the use of Artificial Intelligence (AI) in the International Physicists’ Tournament can be formulated in an enlightened way: **the point of the IPT is to ask of students to make educated and elegant investigations into physical phenomenon, not to say what things are *a priori* and repeat them to a professorial audience**. Such an investigation requires at least what could be formulated as two sides of the same coin: *performance* (or *description)* and *competence (*or *prescription*). Briefly put, performance-description is where the experimental work mostly happens, while competence-prescription is where theory mostly happens.

At the IPT, we argue that true understanding of physical phenomena can only come from the back-and-forth (playful) bouncing between such theoretical and experimental work.

Under a given experimental configuration, the objects under investigation inform the creation of a mathematical model that aims to characterize and often predict the behavior of the objects under study. Such a model will in turn inform new experimental ideas which can lead to new effects, behaviors and potentialities that will endlessly lead to potentially new physical studies.

Any good IPT report is therefore a story that tells of the investigation where, as students, you have learned to ask good questions of your objects and where you have put interesting (and appropriate) mathematics on them.

The experimental aspect of the IPT should be highlighted. The jury will be guided to have a strong sensitivity on the quality of the investigation into the physical phenomenon at hand. Such an investigation would require experimental work in order to be complete. This would of course be modulated by the feasibility and ease of such

investigations with the limited resources that we know bachelors' and masters' students inherently face.

From our experience, this will require that you learn to lose yourself in the process of research and investigation that seems to swallow you entirely under the possibilities to understand a phenomenon in a myriad different ways.

To give an illustrated example: statements such as *"this problem can be well posed using the equations of Newtonian mechanics such that it does not require an experimental investigation"* are not acceptable. Even if we asked you what the value of what the gravitational constant g on earth is, answering 9.81m.s^-2 would not be acceptable. Because what we would be interested in is the measurement of that constant. How did people (scientists) come to discover that g = 9.81m.s^-2 starting without that prior knowledge? How do you construct the structure and experimental setup that allows you to measure such a value, with a double-decimal precision? We bet that if you tried, on the first try you wouldn't get the right value. That is because experimental work always requires you to build a stabilized space where measurement is possible thanks to the prohibition of additional effects that usually come to blur the effects of interest.

The phenomenological nature of the world requires that experiments be built in order to characterize phenomena. This is why the IPT has always seen itself as an experiments-first event.

AI can be a helpful tool, but AI cannot do physics, yet. That's your job. Write your reports that highlight the experimental-theoretical (performance-competence) dyad. Use AI responsibly.