

Paris, 1 October 2024

Object: Opportunity to complete doctoral thesis in physics and complex systems

The question of power and materials for recycling and technology deployment for the ecological transition

The energy transition requires the deployment of new technologies, such as those for producing decarbonized energy. However, this deployment demands significant amounts of materials and energy, raising the need to estimate and model these resource flows.

By modeling mining production, we can assess whether it meets the demand. Yet, mining production is expected to decline due to resource depletion.

To meet medium- and long-term demand, a robust recycling industry must be established. Once again, modeling material and energy flows becomes essential.

Beyond the quantities of energy and materials needed to deploy technologies like photovoltaics or wind energy, it is crucial to analyze the required power. For instance, while the sun provides a vast amount of energy, its power per unit area is limited to solar irradiance, which peaks at 1362 W/m^2 at the top of the atmosphere.

The thesis will focus on modeling material and energy flows, with a particular emphasis on the instantaneous power needed to produce materials and energy systems. For example, one could ask whether a photovoltaic panel generates enough power to produce the materials necessary for its own construction.

A comparison and modelling between industrial physico-chemical recycling and natural “recycling” through biogeochemical cycles and the Earth system could also be envisaged.

This thesis will be part of a national project on strategic metal recycling, under the PEPR recycling initiative (<https://anr.fr/en/france-2030/programmes-et-equipements-prioritaires-de-recherche/>). Within this framework, there is already a physics thesis on global photovoltaic deployment flows and a geopolitical thesis on recycling. The research aims to contribute to public and scientific discussions on the ecological transition.

If you are interested, please send your letter of application and updated CV to jose.halloy@u-paris.fr

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Référence

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Objet

Candidature

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