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Tesis: **"OPTICAL FIBERS AS ACTIVE MEDIA FOR LASERS (RAMAN-TYPE AND TM-DOPED)"**

Resumen:

In this thesis two different main projects were implemented. The first main project is related to RFLs and the second one to doped fiber lasers systems.
The RFL main project was divided in two different investigations; the first one was an experimental study of the signals involved in a RFL under different output coupling conditions. The second one was a demonstration of an alternative to cascade RFL. For the doped fiber laser project, we investigated IR, Vis, and UV generation using new pumping schemes in fluorozirconate fibers.
In the RFL experimental study involving different output coupling conditions, variations in the reflectivity of the output coupler for different cavity laser systems was carried out. We applied conventional cascaded RFL and Random distributed feedback (RDFB) cavities. We concluded that feedback increase does influence negatively on the energy-transfer mechanisms among all the signals involved, hence it also negatively affects the generation threshold for these signals.
In the second RFL study, we proposed a RFL scheme, consisting on modifying a conventional cascade RFL by eliminating the intermediate FBGs, corresponding to cavities for intermediate Stokes signals. In this way, the lower Stokes orders act as virtual links that transfer energy to higher Stokes signals, minimizing the cost of longer fibers and the insertion loss of the FBGs. Regarding rare–earth (RE) doped optical fiber experiments, we propose the implementation of new fiber laser pumping schemes based on fluorozirconate [ZBLAN (ZrF4-BaF3-LaF3-AlF3-NaF)] optical fibers doped with thulium. Our starting point was the analysis of emission and absorption cross-sections of the energy levels of Tm3+ and the spectral analysis of these schemes. Also, we carried out the theoretical calculation of the optimal fiber lengths for obtaining optimal efficiency.
We described for the first time a continuous wave (CW) laser emitting at 806 nm when diode-pumped at 687 nm in a Tm3+: ZBLAN fiber. This device is suitable for first telecom window and sensing applications. We also explored the possibility for obtaining 450 nm (visible) and 360 nm (UV) in Tm3+: ZBLAN by up-conversion with single and double line pumping with 687 nm and 645 nm LDs. These experimental systems would demonstrate that excitation with visible wavelengths between 640 nm – 690 nm (red) may be feasible for the creation of very efficient and highly functional visible (450 nm) and UV (360 nm) fiber lasers for applications in various areas of industry, medicine and computer science.

It is worth mentioning that we are pioneers in proposing these pumping schemes with visible light LDs (red) for the development of new laser systems. These systems have the advantage of working at room temperature in addition that they do not present photodarkening (i.e., the phenomenon in which the losses of the optical power increase in a medium while this is irradiated with light at certain wavelengths), since the visible light realizes a photobleaching (process inverse to the photodarkening) by itself.