IST Project Summary

ZODIAC FP6/IST O17140

ZODIAC
Zero Order Dimension based Industrial components Applied to teleCommunications

The Integrated Project ZODIAC intends to exploit Quantum Dot based semiconductor materials technology in communications systems. To move this new technology into production, ZODIAC provides further improvements in the epitaxial growth control of self-assembled semiconductor nanostructures and in the quantum dot device processing. This must be achieved both at 1.3μm and 1.55μm and on GaAs and InP to reach a level which allows the manufacturing of Quantum Dot based telecom lasers.

ZODIAC *at a glance*

10 Partners: *4 industrials, 3 research institutes and 3 academics:*

- Alcatel Thales III-V Lab, *Coordinator,*(FR)
- Bookham Thecnology PCL (UK)
- Innolume GmbH (DE)
- Nanoplus GmbH (DE)
- CNRS / LPN (FR)
- Ecole Polytechnique de Lausanne (CH)
- Wrocław University of Technology (PL)
- Würzburg University (DE)
- Saint-Petersburg Centre for R&E (RU)
- Tyndall National Institute (IR)

Duration: O1/05/2005 – 30/04/2008
Total cost: 8.78 M€
EC funding: 4.99 M€

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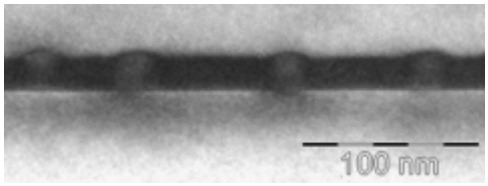
Main Objectives

- To develop growth processes on GaAs and InP based substrates with improved material properties and a better control of the quantum dot growth process,
- To use in nano-engineering degrees of freedom provided by quantum dots to realise dedicated zero dimensional structures for key laser applications,
- To develop and demonstrate key devices for telecom applications based on specific superior quantum dot material properties.
- To explore and demonstrate novel dielectric properties in quantum dot materials



Cross-sectional TEM image of InGaAs columnar QDs in GaAs (LPN/EPFL)

Technical Approach

ZODIAC activities are broken down into 7 work-packages, each comprising 3 or 4 tasks. The technical work has been divided into two core activities: a first level of activities addresses the QD fabrication and processes with two WPs:

- ***WP1**: GaAs-based QD materials*
- ***WP2**: InP-based QD materials*

A second level will demonstrate the fabrication of QD optoelectronic devices within three WPs:

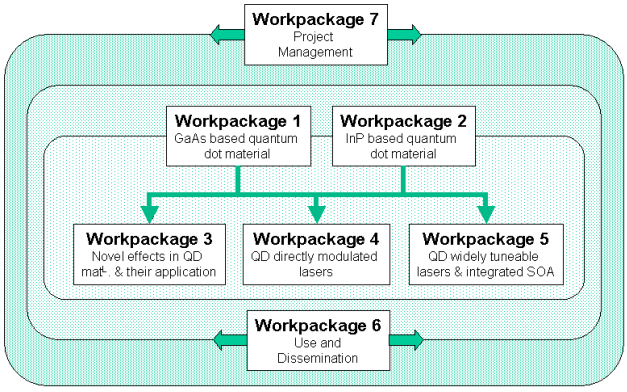
- ***WP3:** Novel effects in QD materials and their Applications*
- ***WP4:** QD directly modulated lasers*
- ***WP5:** QD widely tuneable lasers and integrated SOAs*

A third organisational level will ensure the proper use of the consortium achievements, both through knowledge dissemination and industrial exploitations. These tasks are devoted to a WP:

- ***WP6*** "Use and dissemination"

These six workpackages are embedded into a fourth level which accounts for the organisation of the consortium and its proper management:

- **WP7** "Project management" leads this activity.



Expected achievements

ZODIAC project addresses the **metropolitan area telecommunication network** by developing:

- Directly modulated GaAs-based 1.3µm QD lasers (enabling uncooled and isolator-free operation)
- Directly modulated InP-based 1.55µm QD lasers (enabling uncooled and isolator-free operation)
- Widely tuneable GaAs-based SG-DFB QD lasers for CWDM applications
- 1.55µm InP-based QD tuneable laser covering both C- & L-band (semi-cooled operation).
- Large scale fabrication of both GaAs-based and InP-based QD wafers for specific opto-electronic devices

Expected impact

- **Low cost optical components**. By elaborating both uncooled and isolator-free QD devices, ZODIAC will help the introduction of optical communication close to or up to the home.
- **Broadband-for-all**. Such development is essential to the expansion of the broadband-for-all vision which is commonly acknowledged as being a key to sustainable growth within an economy.
- **IST services.** The active involvement of four industrial partners ensures that the results will be fully exploited commercially. This will clearly have a positive direct impact on job creation, in addition to the indirect impact anticipated from increased access to broadband IST services.

Gas-source MBE for QD epi-wafers fabrication (III-V Lab)