

## NanoICT CP MOLOC : MOlecular LOGic Circuits

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**MOLOC** – Molecular Logic Circuits seeks to design and provide demonstration of principle, feasibility and significant advantages of logic circuits where the basic element is a single molecule (or assemblies of atoms or molecules) acting in itself as a logic circuit. The functionalities provided by this new post-Boolean approach differ in essential ways from using a molecule as a switch. The approach depends on molecules (or nanostructures, etc) having internal degrees of freedom and multiple (quasi)stationary states by virtue of their confined size. We therefore make an advantage of the nanosize which is imposed by the cardinal technological need to reduce the size of the circuit in order to implement complex logic functions at the hardware level and thereby add new functionalities. Exploratory work has shown that it is possible to address the states of a single molecule either electrically (or electrochemically) or optically and also that it is possible to concatenate the logic operation of two molecules. The partners to MOLOC are cognizant that to go beyond the projected limits of CMOS technology will likely be most productive if it be a surface based approach. All the same, foundational work in the gas or liquid phase is also discussed.



MOLOC proposes parallel computing rather than the more familiar sequential model, it proposes to take advantage of inherent internal degrees of freedom of molecules and their dynamics in order to implement finite state machines, machines that can store information to be used later in the computation and to consider circuits where the logic goes beyond Boolean, meaning that variables are not restricted to be either true ( $\equiv 1$ ) or false ( $\equiv 0$ ). Towards its objectives MOLOC proposes to gather a team of European experts in the different and complementary areas of foundational research. The experimental teams can be characterized by the methods used to address (or probe) the molecule. There is also one theoretical work package.

<b>List of Beneficiaries</b>			
	<b>Beneficiary name</b>	<b>Beneficiary short name</b>	<b>Country</b>
1(coordinator)	University of Liège	ULg	Belgium
2	The Hebrew University	HUJI - P2	Israel
3	Technische Universitaet Darmstadt	TU-Darmstadt	Germany
4	Heinrich-Heine-Universitaet Duesseldorf	UDUS	Germany
5	Max-Planck Gesselshaft	MPG	Germany
6	The Hebrew University	HUJI - P6	Israel
7	Techniche Universiteit Delft	TU-Delft	Holland
8	Forschungszentrum Juelich	FZJ	Germany