# POINT-OF-CARE NUCLEIC ACID TESTING


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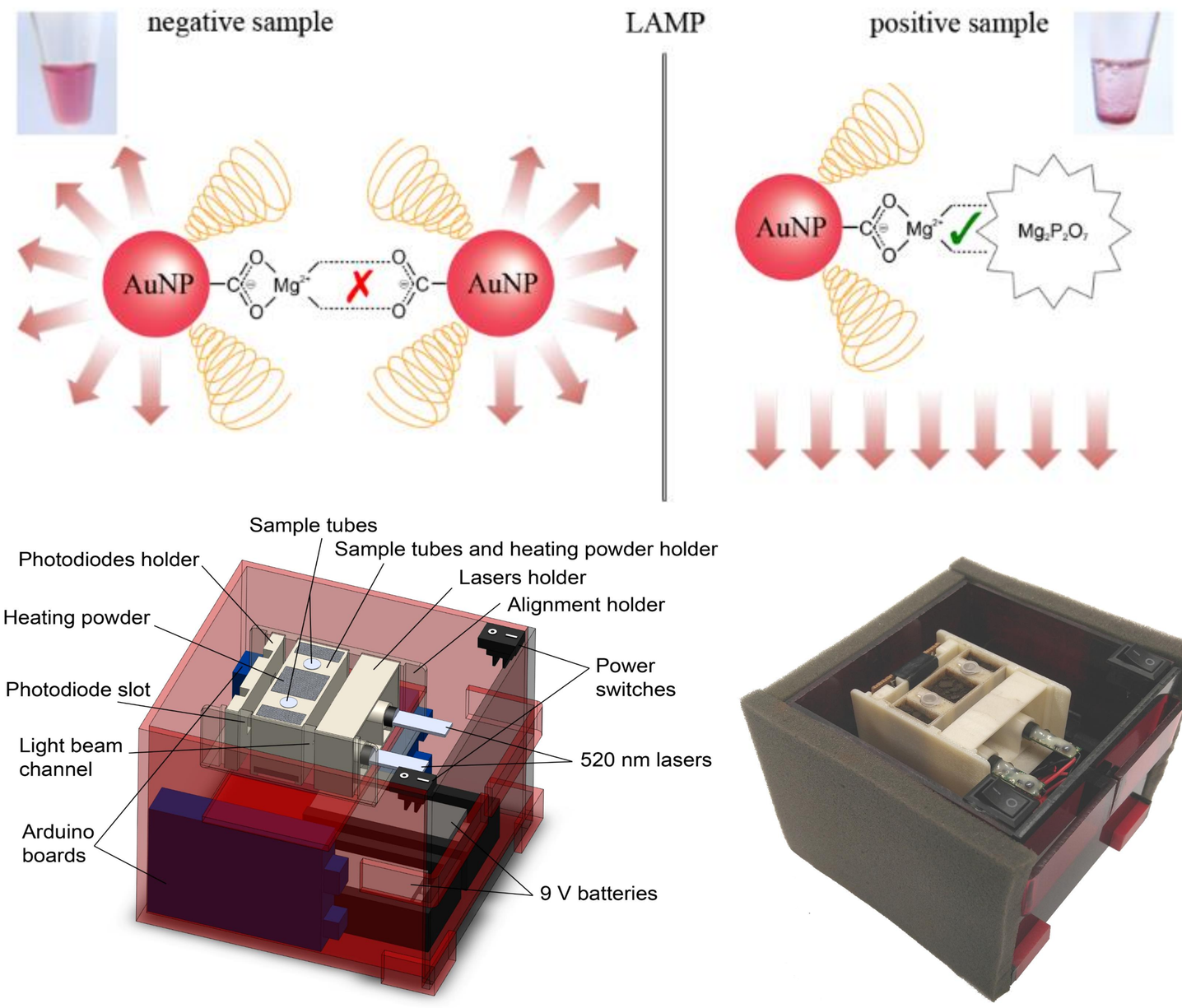
**Gold nanoparticles comodified with thiolated poly(ethylene glycol) and 11-mercaptoundecanoic acid for ultrasensitive DNA detection based on real-time monitoring of loop-mediated isothermal amplification (LAMP)**

Gold nanoparticles have proven to be promising for decentralized nucleic acid testing by virtue of their simple visual readout and absorbance-based quantification. A major challenge toward their practical application is to achieve ultrasensitive detection without compromising simplicity. The conventional strategy of thermocycling amplification is unfavorable (because of both instrumentation and preparation of thermostable oligonucleotide-modified gold nanoparticle probes). In this work, on the basis of a previously unreported coprecipitation phenomenon between thiolated poly(ethylene glycol) / 11-mercaptoundecanoic acid comodified gold nanoparticles and magnesium pyrophosphate crystals (an isothermal DNA amplification reaction byproduct), a new ultrasensitive and simple DNA assay platform is developed. The binding mechanism underlying the coprecipitation phenomenon is found to be caused by the complexation of carboxyl and pyrophosphate with free magnesium ions. Remarkably, poly(ethylene glycol) does not hinder the binding and effectively stabilizes gold nanoparticles against magnesium ion-induced aggregation (without pyrophosphate). In fact, a similar phenomenon is observed in other poly(ethylene glycol)- and carboxyl-containing nanomaterials. When the gold nanoparticle probe is incorporated into a loop-mediated isothermal amplification reaction (LAMP), it remains as a red dispersion for a negative sample (in the absence of a target DNA sequence) but appears as a red precipitate for a positive sample (in the presence of a target). This results in a first-of-its-kind gold nanoparticle-based DNA assay platform with isothermal amplification and real-time monitoring capabilities. Moreover, a palm-sized and low-cost home-made prototype device is used for achieving the required temperature control and real-time signal readout in a simple manner.





Ailin Qin, Lok Tin Fu, Jacky K. F. Wong, Li Yin Chau, Shea Ping Yip, and Thomas M. H. Lee

ACS Applied Materials & Interfaces, 2017, 9, 10472–10480

This work is supported by the Research Grants Council of the HKSAR government (project no.: PolyU 501413) and The Hong Kong Polytechnic University (project nos.: G-YBRU and G-YBFH).