Plans of my research

Hiromasa Moriuchi

I have classified spatial graphs up to ambient isotopy, and believe that my work is the latest frontiers of θ-curve and handcuff graph tables. Recently, M. Chiodo, D. Heard, C. Hodgson, J. Saunderson and N. Sheridan also make a table of knotted 3-valent graphs in similar way to mine. They classify the graphs by using the computer program `Orb` due to Heard, which gives a invariant concerned with their hyperbolic structures. Moreover, they enumerate "θ-polyhedra" by using the computer program `plantri` due to G. Brinkmann and B. McKay.

I am trying to enumerate algebraic tangles with eight crossings, and I think that we can easily make a table of spatial 3-valent graphs with more than seven crossings through `Orb` and `plantri`. In Fact, `plantri` says, there exist 39 planar 3-connected graphs which have two 3-valent vertices and eight 4-valent vertices. I checked these graphs, and I think there exist 35 prime θ-polyhedra with eight 4-valent vertices. It costs much time to obtain spatial 3-valent graph diagrams by substituting tangles for 4-valent vertices. For prime θ-curves and handcuff graphs with up to seven crossings, the Yamada polynomial is very useful to classify them. However, I do not know how powerful the Yamada polynomial for θ-curves and handcuff graphs with more than seven crossings or complete graphs on four vertices. I would like to research this question.

I visited KAIST as a Post-Doctor in 2010, and discussed generalized Kinoshita's θ-curves with Professor K. Ko. Firstly, I finish to write a paper about invariant for generalized Kinoshita's θ-curves. Thereafter, I try to develop a new invariant for vertex connected sum of spatial 3-valent graphs.

Finally, I would like to study about the achirality of spatial graphs. Since there are only three achiral handcuff graphs (and no achiral θ-curves) in my tables, it seems special property. In fact, the achirality is concerned with high polymer chemistry and molecular biology.